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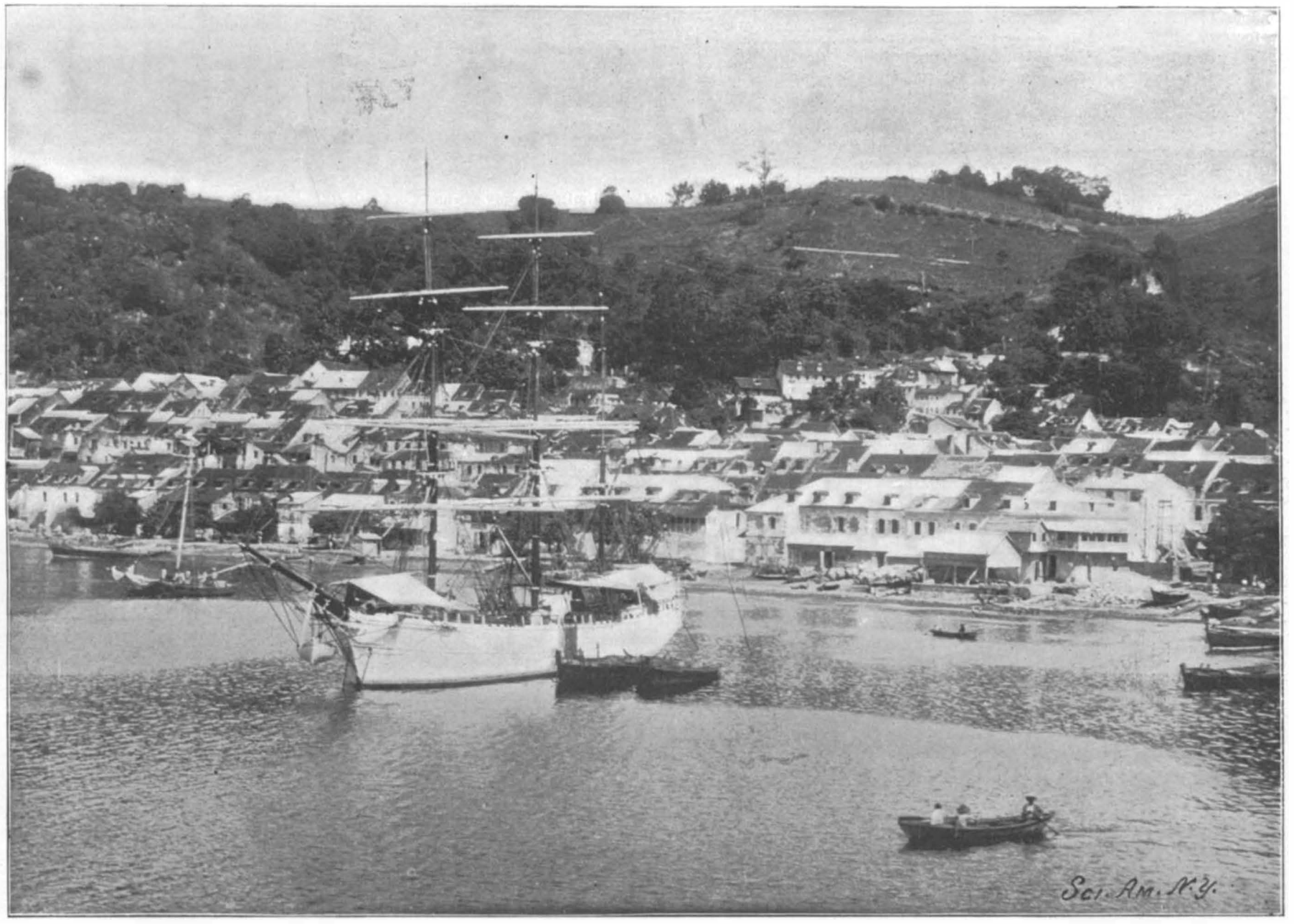
The Cathedral is seen in the center of the town. Pelée's summit is to the right, cloud-capped.

The Roadstead and Town of St. Pierre, with the Ridge leading up to Mont Pelee in the Background.



Photos by Wm. H. Rau.

A Near View of St. Pierre from the Roadstead.

THE GREAT DISASTER IN THE WEST INDIES.—[See page 365.]

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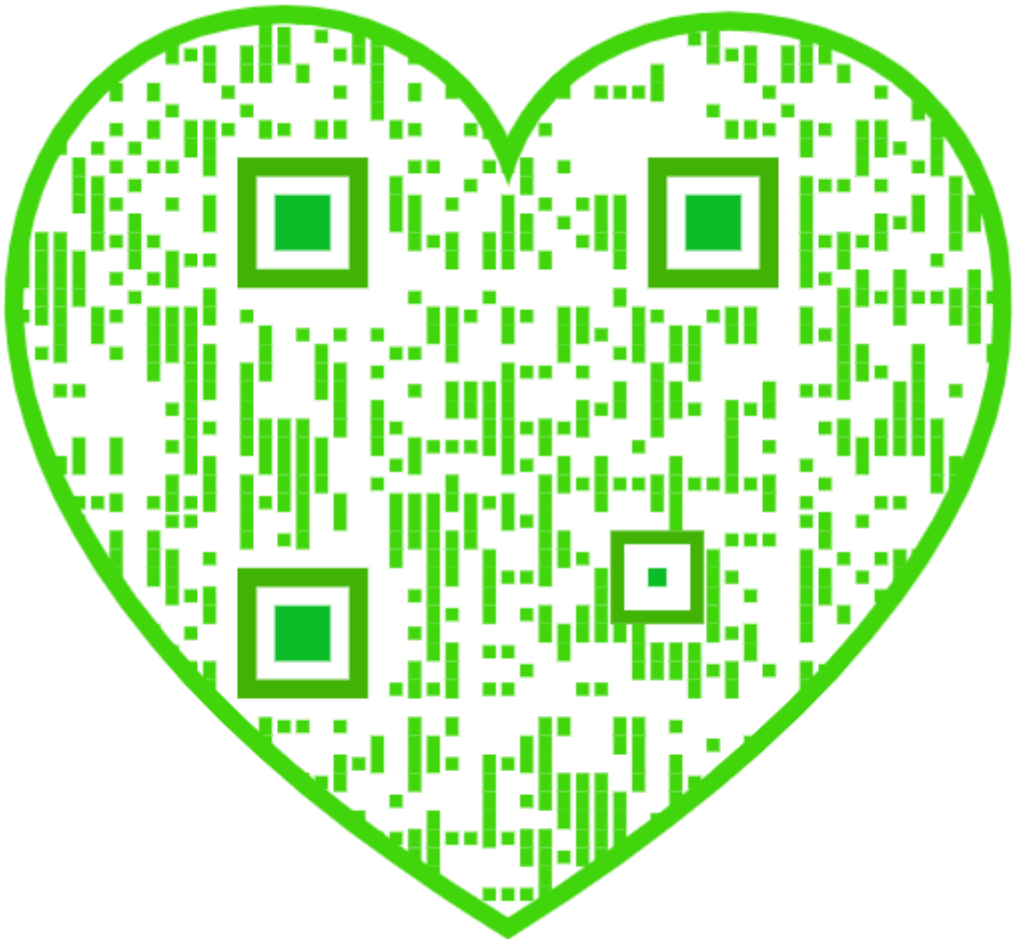

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NEW YORK, SATURDAY, MAY 24, 1902.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

VOLCANIC ERUPTIONS AND THE ISTHMIAN CANAL.

Outside of the lessons of the Martinique disaster that are obvious and applicable to the world at large, this truly horrible convulsion that wiped out a city in a few brief moments carries a special warning for the people of the United States. We refer to the profound importance which is given to the question of seismic and volcanic convulsions as affecting the costly canal which the government is about to construct across the Isthmus.

Of the two possible routes, Panama and Nicaragua, there can be no question, with the red ruin of Pelée before our eyes, that choice must be made of that route, which present physical conditions and local tradition and history prove to be the least threatened with volcanic convulsions.

The situation at Panama may be summed up in the statement that the Isthmus has not been modified since ages before man appeared on the earth; that no trace of volcanic agency can be found there; and that there is within 180 miles of the canal no volcano even of the extinct variety. Nicaragua, on the other hand, has always been a center of seismic disturbances; its route is lined with, or closely approximate to, volcanoes, some of which have shown evidence of tremendous latent energy. Only sixty-four years ago Cosequina, in the northwest of Nicaragua, belched forth for two whole days a mass of matter, that in every six minutes of the eruption, according to M. Buneau-Varilla, would have equaled the whole mass of material to be dug from the Nicaragua Canal. The roar was audible a thousand miles distant, and ashes fell fourteen hundred miles from the Isthmus. Seven years later what is known as "the great earthquake," completely destroyed the city of Rivas, which is only five miles from the Pacific terminus of the canal, and seriously damaged Greytown, the Atlantic terminus.

Comment on these facts is unnecessary, and we do not doubt that the former advocates of a canal at Nicaragua will decide, in the presence of this awful cataclysm at St. Pierre, that the location of the canal in such a center of volcanic action as Nicaragua is simply out of the question.

HAVANA TRANSFORMED.

From one of the most disease-stricken ports in the world, Havana has now been converted into a charming tropical city—a result which has been due entirely to American enterprise in Cuba. What a wonderful sanitary change has been wrought in the old town is graphically told by Major W. M. Black, in the National Geographical Magazine.

Shanties and sheds that had been for decades breeding places for cholera germs were ruthlessly swept away; streets never repaired in the memory of living man were cleaned or repaved; sewers were rebuilt; and houses were unceremoniously entered and disinfected. All this work has been done, not spasmodically, but systematically. Cleaning squads were sent from house to house; apartments were cleaned regardless of the protests of their inmates. The accumulations of years from cellars were thrown out. Such an arbitrary procedure would, no doubt, raise a storm of indignant protest from the people of North America. But the health and safety of Havana demanded it.

The most admirable work of all was the cleaning of the sewers. Not since the day when they were first built had they been looked after. Many of them were choked by the refuse of decades. The American authorities not only managed to repair the sewer system and render it in every way serviceable, but did so without injuring the life of a single laborer. The streets of the city have been cleaned, and in many cases transformed. Narrow thoroughfares have been widened. A magnificent sea wall and a promenade have been built; parks have been cleared and converted from haunts for thieves into pleasure grounds for the people.

The worst pesthole in Havana was the Hospital Militar. To be carried to that place was like being carried to one's grave. Not more than 30 per cent of the patients who entered its walls ever came out alive. American surgeons avoided it; soldiers held their breath when they passed it. The sanitary squad of the Engineer Corps took possession of the building, cleaned it from attic to cellar, coated its walls again and again with whitewash, and finally left the building clean and wholesome. It is now used for a schoolhouse.

Naturally the slothful Cubans disliked the fumigation and disinfection process to which they were subjected. What was good enough for their grandfathers was good enough for them, they thought. Probably most of the Cubans, if the matter of cleaning the city had been put to popular vote, would have decided against the transformation of the town. Now that the streets are cleaned, the parks trimmed and lighted and the sea promenades enjoyable, they have revised their opinions of American extravagance and have even begun to take a certain pride in the new capital. What the effect of the sanitary improvement of the city has been is easily proven by a comparison of the vital statistics in past years. In 1896 no less than 1,262 deaths from yellow fever alone were reported to the city government. The average for the eleven years preceding American occupation was 440 fatal cases. Last year, for the first time in the history of the city, the yellow fever season passed without five fatal cases of the disease. October, November and December, the three months in the year during which the fever was the worst under Spanish rule, passed without a single case.

LIQUID FUEL FOR STEAMSHIPS.

But a few years ago a serious discussion of the possibility of the general substitution of liquid fuel for coal on steamships and locomotives was out of the question, for the reason that the output of oil was inadequate to the supply of more than a very small percentage of the world's steam tonnage. In proof of this it is interesting to refer to the experience of the Pennsylvania Railroad, when the rapid development of the Pennsylvania and Ohio oil fields led to an investigation of the possibilities of oil as a locomotive fuel. While the engineers of this company were engaged in designing the best form of firebox and apparatus for burning oil it occurred to someone to make an estimate of the total amount of oil which would be necessary to run all the locomotives on that great system. The result showed that they would consume more oil than the total output of the United States oil fields of that date.

Although there have been extensive discoveries of oil in various parts of the world, and a great development of special fields such as that at Baku, Russia, the question of the widespread use of fuel oil for locomotives and steamships was governed, up to three or four years ago, by the very limited supply. The government report on the subject for 1901 gives the total output of petroleum for the whole world in 1900 as 155,000,000 barrels. The production in the United States for the same year was 63,000,000 barrels; but in 1901, as the result of discovery and exploitation of the Texas oil fields, the output went up 1,200 per cent to 720,000,000 barrels. There has been an enormous increase also in the world's production, due to the remarkable oil fields in Borneo and Burma. It is impossible to estimate with any accuracy the present world's output, but that it is sufficient to make the supply of oil comparable with that of coal is seen when we bear in mind that to-day there are at least 250 wells in the Texas oil fields alone, which up to last week have shown a flowing capacity of from 50,000 to 160,000 barrels per day. From this we see that during the "gushing" period the rate of output, assuming an average yield of say 25,000 barrels per well, would be equal to a yield of something like two billion gallons per year from the Texas oil fields alone. The gushers, however, are subsiding, and the oil will ultimately have to be drawn out by pumping; but, even allowing for this, it is evident that the oil wells of Texas, California, Borneo and Burma, the four new fields, will yield enough oil to render the general use of liquid fuel in the steamships of the world quite a possibility.

Having eliminated then the question of the scarcity of fuel, it can be said that, looking at every other possible condition of cost, bulk, fuel value, ease of storage, economy of space and wonderful convenience of manipulation in firing, there is everything to be said in favor of liquid fuel at sea. The experience already had with crude oil proves that there is as much fuel value in two tons of oil as in three tons of our coal at $3.50 a ton, and it is found that oil takes not much more than half as much space, weight for weight, as coal, 40 cubic feet of oil being equivalent to 70 cubic feet of coal. As regards the relative cost of the fuels, taking $3.50 as the average price per ton of steam coal as delivered in the bunkers in New York, we find that Texas oil, to compete with this coal, must be delivered on board at about 75 cents per barrel.

There are strong indications that before long fuel oil will be available for steamships in New York at this price and possibly for something less. The question that is confronting the owners of the Texas oil wells is not how much oil is available, but how to get the oil out fast enough to supply the demand. In spite of all the efforts that have been made, the consumption for the past few months has only been a fractional part of the capacity of the wells, a large number of which have been capped and are only awaiting increased transportation facilities by rail and sea before they are opened either to flow by natural pressure or be drawn upon by pumping. The railroads are making heroic efforts to transport the oil, and there are now several large tank steamers under construction at the various Atlantic shipyards. A number of pipe lines have been built from the wells to Port Arthur at the mouth of the Sabine Pass, and it is probable that within another twelve months the shipments from Beaumont will have increased enormously. As to the price at which the oil will be delivered in New York, it is difficult to predict with any certainty. There is a charge of ten cents per barrel for carrying oil through the pipe lines to Port Arthur. At the wells oil is selling as low as six to eight cents a barrel, and there is a rate of forty-five cents per barrel from Port Arthur to New York city for tank steamers. At that rate the actual cost at present of the oil delivered in this city would appear to be something over sixty cents a barrel.

It would seem, therefore, that fuel oil to-day could be sold at a profit and yet compete in price with steamer coal, the two fuels standing in this respect upon an equal footing. The enormous advantages of fuel oil, however, become manifest at once when we consider the question of storage in the ships and use in the furnaces. Thus, taking such a vessel as the "Kronprinz Wilhelm," which carries about 4,500 tons of coal in her bunkers, we find that instead of 4,500 tons of coal she would require on the basis of two to three only 3,000 tons of oil, a clear saving of 1,500 tons of dead weight. On the basis of bunker space allotted, there would be a saving of about 90 per cent, and this in a high-speed express steamer like the "Kronprinz Wilhelm," which can carry at the best probably not more than 500 or 600 tons of freight, when running with coal, would be of enormous value; for the fuel oil has this great advantage that it can be stored in the cellular double bottom of the ship, leaving the entire bunker space for increased stores and cargo. Furthermore, the use of oil would cause an immediate and very great reduction in the boiler room staff. There would be no need of an army of coal passers and firemen; for the oil burners, when once started, require nothing more than the intelligent oversight of a few first-class firemen whose duties would be rather those that fell to an engineer of the lower grade. It is estimated by Mr. Clement A. Griscom, of the American Line, that by the use of fuel oil on their ships the boiler room staff could be reduced 80 per cent. There are, moreover, other subordinate but very important advantages arising from the use of fuel oil, such, for instance, as the great ease and cleanliness of taking the fuel on board, for it would flow into the double bottom through pipes by gravity, and there would be none of the objectionable dust and dirt which is inseparable from coaling a vessel. As to its convenience for a ship on an extended journey, there are at present over thirty localities throughout the world where the fuel is stored and may be secured, and the number of storage stations will multiply rapidly as the fuel comes into more general use.

FUSION OF QUARTZ.

Some interesting experiments in connection with the fusing of quartz have been carried out with great success by Mr. R. S. Hutton, of the Owens College, Manchester. Quartz is much preferable to glass for the manufacture of certain physical apparatus, especially those of a delicate nature, and those required for high-temperature gas investigations, but its application is very limited, owing to the great difficulty of fusing it. Hitherto the oxyhydrogen blowpipe only has been used for fusing the quartz, but its success is not very complete, owing to the fact that the temperature thus generated is only a little higher than the melted silica itself. This fact led Prof. Moissan and other prominent French scientists to achieve the desired end by the utilization of the electric furnace, but their researches did not accomplish so great a result as was anticipated. Mr. Hutton, however, was convinced that the electric furnace was the only means by which the silica could be reduced to a molten condition, and he thereupon conducted his experiments upon the lines of Moissan, and some interesting effects of the arc upon the silica were observed. The most salient advantage that molten silica possesses over glass is that it may be plunged into cold water, no matter to what

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degree of temperature it may have been heated, and it will not crack. Mr. Hutton employed the Moissan furnace for his researches, but incorporated some special features of his own design. The furnace was composed of a lower grooved block of magnesia with arrangements for the arc carbons, placed at right angles to the groove in the lower block, and an upper block plate. The graphitic carbon support—graphitic carbon was employed, as this material is absolutely pure, so that the fused silica cannot become impregnated with ashes—fitted into the groove. The quartz to be fused was granulated and placed upon the carbon support. A current of 300 amperes and 50 volts was brought to play upon the quartz, and in a few seconds it was melted. The support was then pushed further in, so that a fresh quantity of the powdered silica was brought under the influence of the arc. By this means Mr. Hutton has been successful in making rods and tubes one foot long from powdered quartz. In the manufacture of thick tubes of quartz Mr. Hutton employed a quartz mould with a carbon core about one-eighth inch in diameter with carbons to support it at either end. In the course of these experiments Mr. Hutton observed that the silica in the immediate neighborhood of the arc was inclined to change to silicon, but the black stain disappeared immediately the portion was removed from the center of the arc. The silica does not adhere to the carbon, as might be supposed, as it is powdered, so it can be easily separated from the core and the carbon support. Mr. Hutton, however, has not yet succeeded in obtaining a tube quite immune from bubbles, but he found that after the tubes had been made, if they were once more heated in the arc, they were considerably improved.

A NEW REVISED DESIGN PATENT LAW.

Congress has recently revised and amended the law concerning Design Patents, which act was approved May 9, 1902, and section 4,929 of the Revised Statutes was amended. The statute before and after amendment is shown in parallel columns for purposes of comparison:

Statute. R. S. Sec. 4,929.	Statute. Sec. 4,929 as amended by Act of May 9, 1902.
Any person who by his own industry, genius, efforts and expense, has invented and produced any new and original design for a manufacture, bust, statue, alto-relievo, or bas relief; any new and original design for the printing of woolen, silk, cotton, or other fabrics; any new and original impression, ornament, pattern, print, or picture to be printed, painted, cast or otherwise placed on or worked into any article of manufacture; or any new, useful and original shape or configuration of any article of manufacture, the same not having been known or used by others before his invention or production thereof, or patented or described in any printed publication,	Any person who has invented any new, original and ornamental design for an article of manufacture not known or used by others in this country before his invention thereof and not patented or described in any printed publication in this or any foreign country before his invention thereof or more than two years prior to his application, and not in public use or on sale in this country for more than two years prior to his application, unless the same is proved to have been abandoned,
may, upon payment of the fee prescribed, and other due proceedings had, the same as in cases of inventions or discoveries, obtain a patent therefor.	may, upon payment of the fees required by law and other due proceedings had, the same as in cases of inventions or discoveries, covered by sec. 4,886, obtain a patent therefor.

The changes made by the amendment are the following:

1. The word "useful" is omitted, and the word "ornamental" substituted in place thereof, as qualifying the designs.

2. The term "an article of manufacture" is made to replace the specification of particular matters in the prior statute.

3. The statutory bars to the issuance of a patent which were construed into the prior statute by virtue of the provisions of section 4,933 R. S., are included in in terms in the amended statute.

As to the substitution of the word *ornamental* for the word "useful," it is to be noticed that the form of section 4,929, as it appeared before amendment, in the Revised Statutes, was substantially the same as in the first design patent act of 1842, excepting that the law of 1870 removed the word "useful" from its place before the word "pattern" to the clause next succeeding, where it was inserted as qualifying shape or configuration. From the time of the first passage of this law in 1842 down to 1869, it was said by Commissioner Foote in *ex parte* Jason Crane:

"The construction which has been given to that act by the office ever since its passage in 1842 is that it relates to designs for ornament merely, something of an artistic character, as contradistinguished to those of convenience or utility."

And the Supreme Court of the United States said in the case of the Gorham Company v. White, decided in December, 1871:

"The acts of Congress which authorize the grant of patents for designs were plainly intended to give encouragement to the decorative arts. They contemplate not so much utility as appearance."

Commissioner Foote, however, held in the Crane case that a useful design might receive protection under the statute, and in this he was followed by Commissioner Fisher in *ex parte* Bartholomew, decided in December, 1869.

This practice was reversed in 1871, by Commissioner Leggett in *ex parte* Parkinson, who said:

"The law has provided for granting patents to the inventors or discoverers of new and useful arts, machines, manufactures, and compositions of matter, and also of any improvements thereof. The law authorizing design patents was intended to provide for an entirely different class of inventions, inventions in the field of æsthetics, taste, beauty, ornament.

"The question an examiner asks himself while investigating a device for a design patent is not 'What will it do?' but 'How does it look?' 'What new effect does it produce upon the eye?' The term 'useful' in relation to designs means adaptation to producing pleasant emotions."

It is thus apparent that there has been diversity of opinion as to the meaning of this design patent statute among the different Commissioners, and the statute has received different interpretations at different times.

In the case of Smith v. Whitman Saddle Company, 148 U. S., 674, the Supreme Court said, speaking of this statute:

"To entitle a party to the benefit of the act, in either case (mechanical inventions or designs), there must be originality, and the exercise of the inventive faculty; in the one there must be novelty and utility; in the other originality and beauty. Mere mechanical skill is insufficient. There must be something akin to genius, an effort of the brain as well as the hand. The adaptation of the old devices or forms to new purposes, however convenient, useful, or beautiful they may be in their new rôle, is not invention."

It is to be observed that in this opinion the "utility" of the mechanical patent statute is placed in opposition to the "beauty" of the design patent statute, although the word "useful" was in each of these statutes.

In 1899 the Circuit Court of Appeals of the Sixth Circuit, in the case of Westinghouse Electric Company v. Triumph Electric Company, spoke in regard to this matter, saying:

"We should think it very doubtful whether the word 'useful,' introduced by revision of the patent laws into the statute, is to have the same meaning as it has in the section providing for patents for useful inventions. The whole purpose of Congress, as pointed out by Mr. Justice Strong, speaking for the Supreme Court, in the case of Gorham Co. v. White (14 Wall., 511), was to give encouragement to the decorative arts. It contemplated not so much utility as appearance. We must infer that the term 'useful' was inserted merely out of abundant caution to indicate that things which were vicious and had a tendency to corrupt and in this sense were not useful, were not to be covered by the statute."

Referring to the case of Smith v. Whitman Saddle Company, the Court of Appeals of the District of Columbia said, in *ex parte* Tournier, 94 O. G., 2,126, February, 1901:

"We do not, however, understand the court as intending to go further than this and to hold that functional utility is to be regarded as a controlling or even an essential element in a patent for a design. For if so, the design patents would virtually be placed upon the same footing and with the same requirements of patents for mechanical inventions."

Following this same view of the force to be given to the word "useful" in this statute, the Circuit Court of Appeals of the Second Circuit, in the case of Rowe v. Blodgett & Clapp Company, 112 Fed. Rep., 61, adopted the language of the Circuit Court and referred to this subject as follows:

"I decide this case upon the broader ground that patents for designs are intended to apply to matters of ornament, in which the utility depends upon the pleasing effect imparted to the eye and not upon any new function. Design patents refer to appearance, not utility. Their object is to encourage works of art and decoration which appeal to the eye, to the æsthetic emotions, to the beautiful."

And in this case the court criticized the attitude of the Patent Office, saying:

"The practice of the Patent Office in issuing design patents seems not to have been uniform. Prior to 1871 it was not only liberal but lax, until in a carefully considered opinion Commissoner Leggett (*ex parte* Parkinson) conformed it to a construction of the law which subsequently found approval in the cases above cited."

This opinion concludes:

"But the designs of articles of manufacture not otherwise entitled to receive design patents cannot justify the issuance of such patents on any theory that the design is a trademark."

In view of these decisions, section 4,929 was difficult to understand in respect to the question of utility, and it resulted from this that many applications for design patents were filed for unpatentable subject-matter, to the disparagement of the whole patent system.

Immediately following the publication of the decision of the Circuit Court of Appeals in Rowe v. Blodgett, present Commissioner of Patents Allen squared the practice of the Patent Office with it and drafted the new section of the statute above quoted, which was introduced in Congress as Senate Bill 4,647. The Commissioner also submitted a written argument in its favor, which was embodied in the favorable report of the Patent Committee of the Senate. The new law is the first to set up a clear distinction between patents for articles having a shape or form relating to mechanical function only and things whose shape is ornamental and intended to produce pleasing emotions, without reference to functional utility.

In Commissioner Allen's argument before the Senate Committee on patents he said:

"It is thought that if the present bill shall become a law the subject of design patents will occupy its proper philosophical position in the field of intellectual production, having upon the one side of it the statute providing protection to mechanical constructions possessing utility of mechanical function, and upon the other side the copyright law, whereby objects of art are protected, reserving to itself the position of protecting objects of new and artistic quality pertaining however, to commerce, but not justifying their existence upon functional utility. If the design patent does not occupy this position there is no other well-defined position for it to take. It has been treated of late years as an annex to the statute coverng mechanical cases, since the introduction of the word 'useful' into it. It is thought that this practice should no longer continue."

In view of these decisions of the courts, construing the meaning of the word "useful" in the prior statute, the amendment which strikes out the word "useful" and substituting "ornamental" in its place, clears up the proper construction of the statute and expresses what was already included by construction of the prior statute, making the statute itself a guide to practice.

THE BRITISH SUBMARINES.

BY ERNEST ASHLEY.

During the last few weeks Submarine No. 1, one of five submarines now being constructed by Messrs. Vickers, Sons & Maxim for the British Admiralty, at a cost of £34,000 each, has been submitted to exhaustive trials at Barrow. The vessel was taken off Molney Island, where she maintained a speed of eight knots an hour, and when traveling with her turret awash the speed is considerably over that. Afterward she was submerged to the depth of 15 feet and for six miles the submarine ran under these conditions. The submarine was accompanied by the Furness Railway's twin-screw tugboat "Furness," with divers on board in case of emergency. The trials were conducted by Capt. Baron, R. N., D. S. O., and Capt. Cable, the celebrated submarine expert, who represents the inventors. The engineer officers and men attached to H. M. S. "Hazard" have been instructed in the construction and mechanism of the submarine by Capt. Cable and Mr. Monell. The boat is of the improved Holland type, the patent rights of which throughout the world—except in the United States of America—have been purchased by Messrs. Vickers. The boat has a length of 63 feet 4 inches, with a diameter of 11 feet 9 inches and a displacement of 120 tons when totally submerged. The hulls are divided internally into water-tight compartments by steel bulkheads. A 160 horse-power four-cylinder Otto gasoline engine is used for surface work. A 70 horse-power dynamo is run by her gas engine to store electricity when the boat is on the surface, and when going under, the gas engine is thrown out of gear and the dynamo is used as an electric motor, taking current from the cells it has stored. Should a torpedo be discharged from beneath the surface, trimming and ballast tanks, working automatically, compensate for the lessened displacement and maintain the ship in horizontal position. The submarine is capable of traveling 400 miles without exhausting the fuel supply, and to remain under water 48 hours at a stretch. Selected crews are to be trained this summer for the working of the new craft. Capt. Cable has now left for America.

SCIENCE NOTES.

In the museum at the University of Arizona at Tucson, a skeleton of a very large whale found in the desert south of Yuma has been mounted. Other finds of rare value have been made in this same region. In the University museum are the tusks and lower jaw of an elephant found in the Yuma desert.

The journey of a bottle from central Illinois to the Pacific Ocean has just come to light through the receipt of a letter by Walter Roeder, of Bloomington, Ill., from Jesse Wilson, of Santa Monica, Cal., saying that he had found a bottle off the coast of California which contained a letter written by Roeder and asking the finder to inform him when and where it was found. The letter was written on January 27, 1900, and after being placed in the bottle the receptacle was cast into the water of the Mackinaw River, ten miles west of Bloomington. The bottle must have followed the river until the confluence with the Illinois was reached and thence floated to the Mississippi and through the Gulf of Mexico to the Atlantic Ocean. The currents of the ocean are supposed to have carried the bottle around Cape Horn and thence up the Pacific coast. The journey exceeded 10,000 miles. The bottle and message betrayed little evidence of the long journey.

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A NOVEL TOOL-GRINDING ATTACHMENT.

Prof. C. V. Boys, of the Royal Society of Great Britain, has designed a novel tool-grinding attachment, the object of which is to provide a means economical, handy and easily understood by a mechanic, of accurately grinding lathe and planing tools. It is not a universal grinder, and it will not grind reamers, milling cutters, and a number of things for which well-known but expensive and elaborate tools are essential. But what it does do it does easily and well, and is especially applicable in small shops where expensive grinding machinery is not required. It is true it only does what the average workman himself thinks he can do sufficiently well, but the better the workman the more he knows that he dare not, especially with cranky and awkward tools, approach so near to the proper relief angle as he should, and the more ready he is likely to be to welcome a simple and handy, but accurate guide.

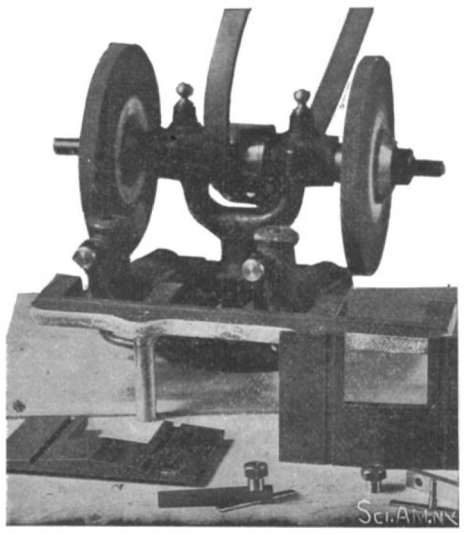


Fig. 1.—TOOL GRINDER WITH REST DETACHED.

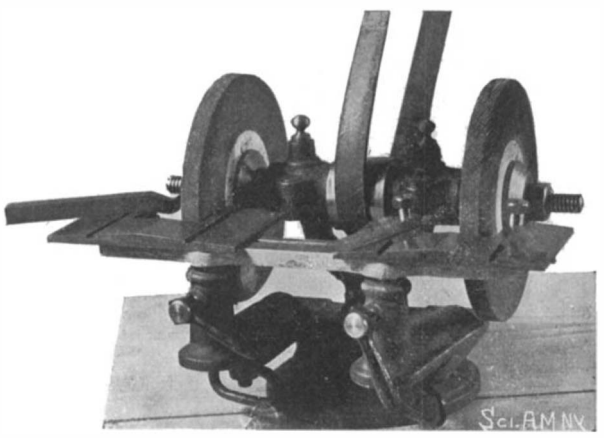


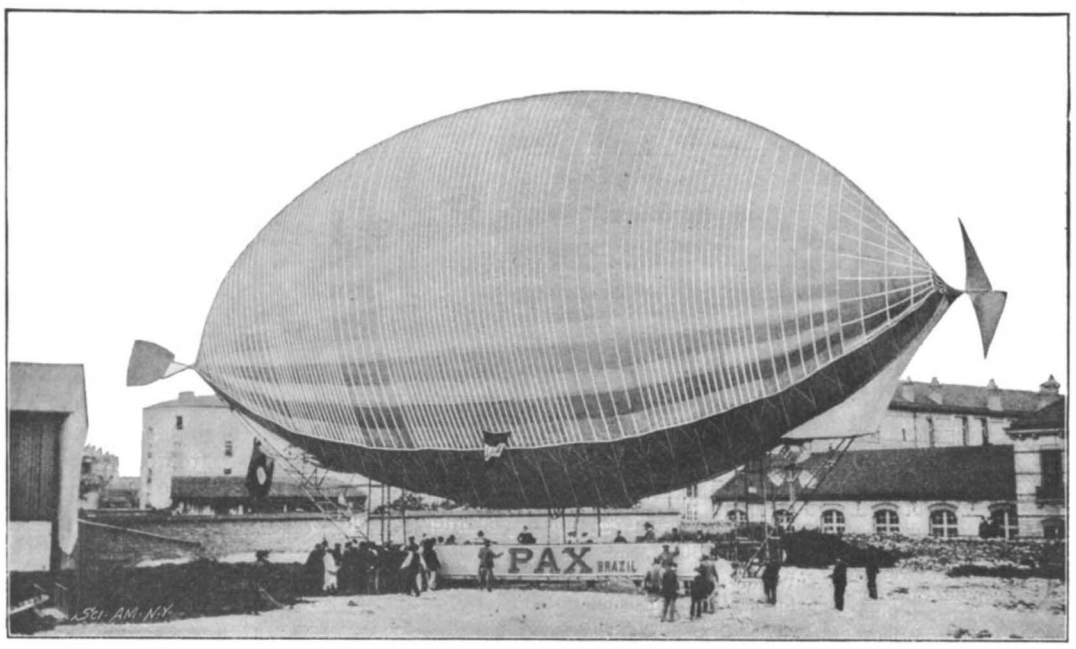
Fig. 2.—GRINDER WITH REST IN PLACE.

It is a simple device, consisting, as will be seen from the illustration, of an ordinary grinding head with a pair of wheels made to carry a platform of double U-form in plan, in which there is a longitudinal groove. In general, the platform is clamped, so that the groove is parallel with the axis of the grinding head. Upon the platform rest two double inclines, the form of which is very clearly seen in Fig. 1, while they are shown in position in Fig. 2. One of these, which is made to embrace the coarser cutting wheel, is sloped on each side to an angle of say 5 degrees, while the other, which embraces the fine cutting and finishing wheel, is sloped on each side one degree less.

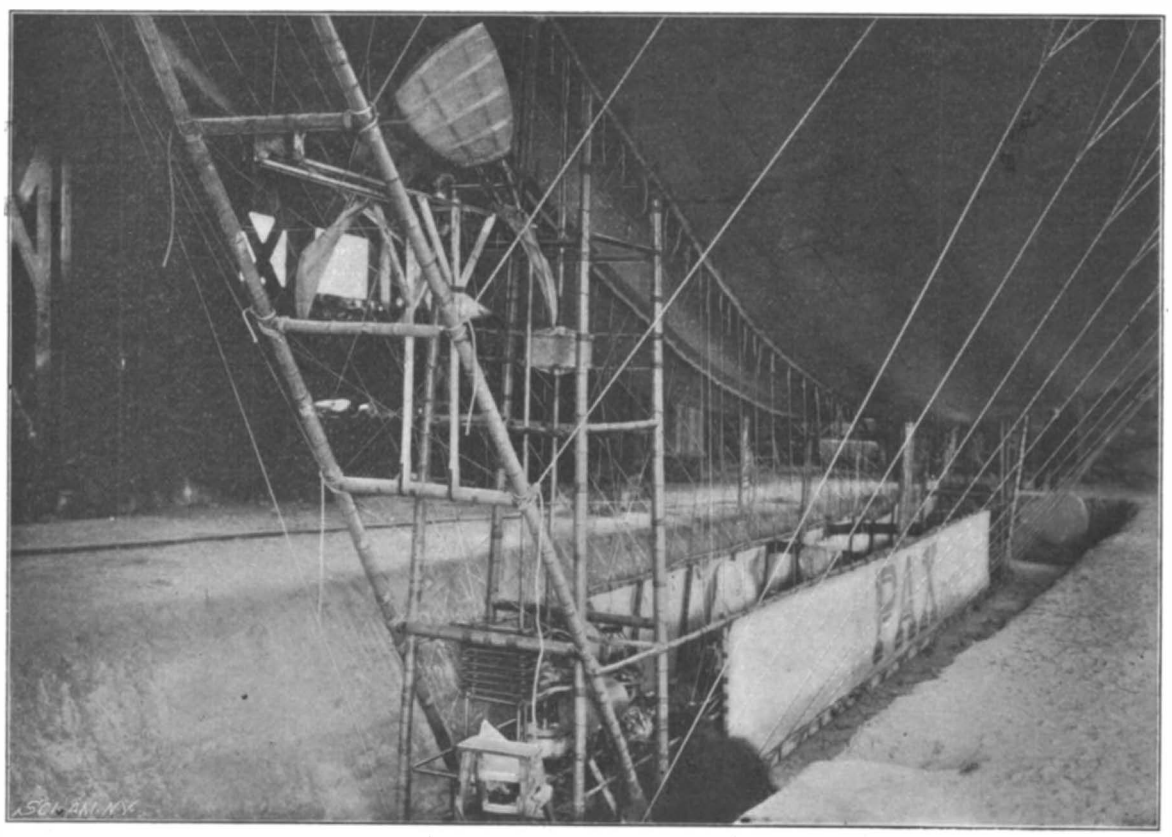
Suppose it is desired to grind a round-nose tool, in which, of course, there is no profile angle, it is laid by its shank upon the steeper double incline, and its round nose is brought to bear lightly against the flat face of the wheel, while the shank is swept over the incline. This is done on each side of the coarser wheel, and a relief angle of 5 degrees is accurately ground. It is then picked up, and with one light sweep on each side of the fine wheel, the edge only is finely ground to one degree less. If the tool is cranked below the shank level, the open mouth of the double incline gives room for the crank as shown at the left of Fig. 2, or if it is a very small tool adapted with a holder, it may be at once supported closely to the wheel. The fine grinding need not extend more than a very little way down below the edge, but with a light and rapid sweep it will reach to the bottom. Should it be arrested before this, the resulting angle of 179 deg. is seen perfectly clean and sharp, thus testifying to the precision in the work done.

Next suppose that a tool is required with definite profile angles. For this purpose the angle guides seen in Fig. 1 are set on a protractor. They are then laid in the grooves of the steeper double incline one on each side, as shown to the right of Fig. 2, and the shank of the tool is brought up against the guide, resting at the same time on the inclined face. The edge is then traversed up and down the face of the wheel, under a light pressure. As the vibration keeps the double incline almost floating, this can readily be accomplished with the greatest delicacy. As soon as the angle grinding is finished, the tool is picked up with its guide, and placed upon the less sloping double incline of the finishing wheel, and a delicate sweep taken across its face. The obtuse angle of 179 deg. will now be far more conspicuous than it was in the case of the round-nose tool. The other edge, or as many as there may be, are then ground in the same way.

A screw-cutting tool ground as exactly as described would suffer from the defect that its nose would not be inclined to the angle of the rake of the thread, and thus would cut more keenly on one side than the other. This difficulty is overcome by the simple device of tilting the whole platform to an extent, determined by a washer, stamped with a number representing the diameter divided by the pitch. The effect of this is to alter automatically all the angles, so that the relief is right on both sides, and the nose of the tool slopes at the same angle as the rake of the thread. It may be mentioned that not only is a tool ground accurately and more quickly by this simple contrivance than by hand, and when ground it need not be tested by an angle gage, but when applied it may be set in the slide rest correctly by its shank, instead of by the short cutting edges and the angle gage, which is necessary when hand grinding is resorted to. Then there is no fear of the two sides of a thread having different angles if they are desired to be alike. There is one feature of this grinder that may not be apparent at first sight, though it is obvious when pointed out. If the protractors are each set to say 30 deg., the edges of the tool will make an angle of 60 deg. with one another, symmetrically situated with respect to the shank as already explained. This will cut a screw thread in which the angle as tested in the axial plane is 60 deg., but the actual angle measured across the thread will be just under 60 deg., namely, such an angle as projected will appear as 60 deg. Now, if the tool had been ground by its edge, tested with a protractor so as to be exactly 60 deg., the form of the thread as seen in an axial section would be just over 60 deg. In most cases the change in the angle due to projection would not be enough to be of any consequence; but where such precision is essential, it is convenient to be able to set the guides to the angle, as shown in an axial section direct without having to make the calculation or allowance for the effect of projection.



First Trial of the "Pax" on May 4, 1902.



The Car, Motors, and Steering Propellers of the "Pax."

AIRSHIP "PAX," IN WHICH SEVERO LOST HIS LIFE.

TOTAL WRECK OF THE SEVERO AIRSHIP.

To the list of enthusiastic aeronauts who have sacrificed their lives in the interests of aerial navigation, the name of Augusto Severo must now be added.

At about 5 o'clock on the morning of May 12, a crowd of spectators was gathered in the airship grounds in the Rue Quintinie to witness the ascent of Severo in his airship "Pax." In the car were Señor Severo and his engineer Sachet. It is said that at starting there seemed to be some difficulty with the steering gear and the propellers. But after several stoppages the airship sailed off steadily enough in the direction of Issy, where the experiments were to be made. As the ship hovered over the Avenue Demaine, she was caught by a puff of wind and blown about in such a fashion that to the onlookers it became immediately apparent that Severo had lost all control. A bright flash of light suddenly enveloped the balloon. A loud report instantly followed. From a height of 1,500 feet the machine fell toward the earth, crashing through branches of trees, finally landing in the Avenue Demaine. Severo was hurled from the balloon as it fell, and struck the ground near the Mont Parnasse station. He was picked up a mangled corpse. He struck the ground feet first, and with such velocity that the bones of his legs were forced through the soles of his boots. Sachet, it seems, was burnt to death.

At this early date it is rather difficult to explain the cause of the accident. The men who built the balloon claim that the accident was due to the explosion of one of the reservoirs. Santos-Dumont holds that Severo's motor was located much too near the gas bag, and that as Severo rapidly arose the gas expanded and was driven out through the valve and sent against the motor. Col. Renard, of the French army's balloon di-

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vision, agrees with Santos-Dumont, and also believes that Severo owed his death to his ignorance of aerostatics.

We present two illustrations of the airship, taken soon after its completion. It will be seen that in a general way it resembled the later craft, Number 7, built by Santos-Dumont; though there are points of difference, in some of which it is inferior to and in others an improvement on that machine. It is evident, at a glance, that the car or navigating platform is carried much nearer to the balloon than it was in the Santos-Dumont ship, and the danger of ignition of the escaping gas, which owing to the ascent of the ship would flow downward toward the car, is at once evident.

This placing of the car so close beneath the balloon was evidently done with the object of improving the control by bringing the center of resistance as close to the center of effort of the propellers as possible. For the same reason the propellers were placed on the axis of the balloon. Severo also endeavored to further improve the control by adopting a fuller model for the gas bag, using a ratio of 5 to 2 in the "Pax," as against a ratio of 1 to 6 in Santos' airship.

The larger of our illustrations shows that the gas bag was partially divided by a deep longitudinal depression on the under side. The car was built of bamboo framing trussed with steel wire. A decided novelty was the use of two steering propellers arranged transversely to the axis of the airship—a very doubtful improvement, we should say, over the ordinary rudder of large area.

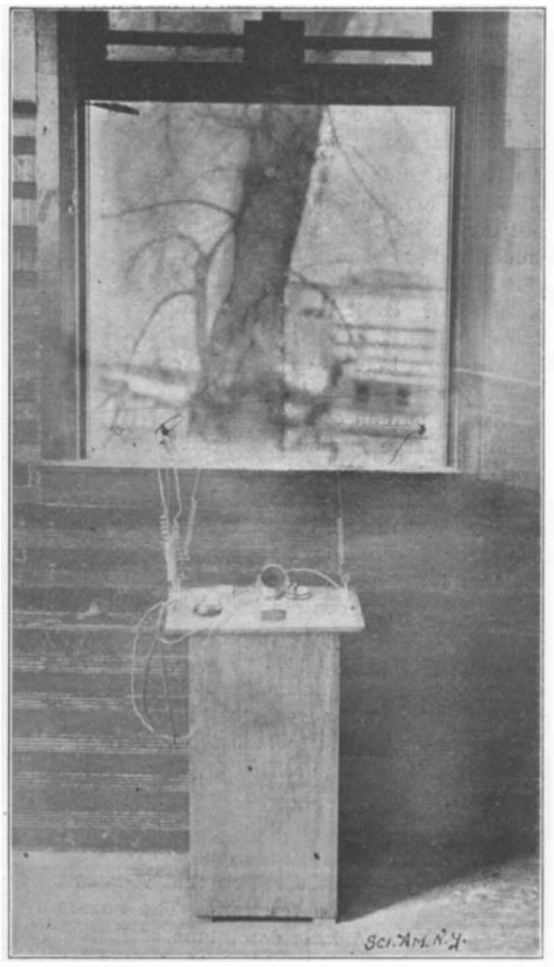
THE LATEST ADVANCE IN WIRELESS TELEPHONY.

BY WALDON FAWCETT.

The latest and one of the most interesting systems of wireless communication with which experiments have recently been conducted is the invention of Nathan Stubblefield, of Murray, Ky., an electrical engineer who is the patentee of a number of devices both in this country and abroad. The Stubblefield system differs from that originated by Marconi in that utilization is made of the electrical currents of the earth instead of the ethereal waves employed by the Italian inventor, and which, by the way, it is now claimed, are less powerful and more susceptible to derangement by electrical disturbances than the currents found in the earth and water. In this new system, however, as in that formulated by Marconi, a series of vibrations is created, and what is known as the Hertzian electrical wave currents are used.

The key to the methods which form the basis of all the systems of wireless telephony recently discovered —the fundamental principles of wireless telephony, as it were—was discovered at Cambridge, Mass., in 1877 by Prof. Alexander Graham Bell, the inventor of the telephone system which bears his name. On the occasion mentioned Prof. Bell was experimenting to ascertain how slight a ground connection could be had with the telephone. Two pokers had been driven into the ground about fifty feet apart, and to these were attached two wires leading to an ordinary telephone receiver. Upon placing his ear to the receiver, Prof. Bell was surprised to hear quite distinctly the ticking of a clock, which after a time he was able to identify, by reason of certain peculiarities in the ticking, as that of the electrical timepiece at Cambridge University, the ground wire of which penetrated the earth at a point more than half a mile distant.

Some five years later Prof. Bell made rather extensive experiments along this same line of investigation at points on the Potomac River near Washington, but these tests were far from satisfactory. It was found on this occasion that musical sounds transmitted by the use of a "buzzer" could be heard distinctly four miles distant, but little success was attained in the matter of communicating the sound of the human voice. Meanwhile Sir William Preece, of England, had undertaken experimental study of the subject of wireless telephony, and during an interval when cable communication between the Isle of Wight and the mainland was suspended, succeeded in transmitting wireless messages to Queen Victoria at Osborne by means of the earth and water electrical currents.



STUBBLEFIELD APPARATUS.

Mr. Stubblefield's experiments with wireless telephony dated from his invention of an earth cell several years ago. This cell derived sufficient electrical energy from the ground in the vicinity of the spot where it was buried to run a small motor continuously for two months and six days without any attention whatever. Indeed, the electrical current was powerful enough to run a clock and several small pieces of machinery and to ring a large gong. Mr. Stubblefield's first crude experiments looking to actual wireless transmission of the sound of the human voice were made without ground wires. Nevertheless, by means of a cumbersome and incomplete machine, without an equipment of wires of any description, messages were transmitted through a brick wall and several walls of lath and plaster. As the development of the system progressed, the present method of grounding the wires was adopted, in order to insure greater power in transmission.

The apparatus which has been used in the most recent demonstrations of the Stubblefield system, and which will be installed by the Gordon Telephone Company, of Charleston, S. C., for the establishment of telephonic communication between the city of Charleston and the sea islands lying off the coast of South Carolina, consists primarily of an ordinary receiver and transmitter and a pair of steel rods with bell-shaped attachments which are driven into the ground to a depth of several feet at any desired point, and which are connected by twenty or thirty feet of wire to the electrical apparatus proper. This latter consists of dry cells, a generator and an induction coil, and the apparatus used in most of the experiments thus far made has been incased in a box twelve inches in length, eight inches wide and eighteen inches in height. This apparatus has demonstrated the capability of sending out a gong signal as well as transmitting voice messages, and this is, of course, of great importance in facilitating the opening of communication.

The most interesting tests of the Stubblefield system have been made on the Potomac River near Washington. During the land tests complete sentences, figures, and music were heard at a distance of several hundred yards, and conversation was as distinct as by the ordinary wire telephone. Persons, each carrying a receiver and transmitter with two steel rods, walking about at some distance from the stationary station were enabled to instantly open communication by thrusting the rods into the ground at any point. An even more remarkable test resulted in the maintenance of communication between a station on shore and a steamer anchored several hundred feet from shore. Communication between the steamer and shore was opened by dropping the wires from the apparatus on board the vessel into the water at the stern of the boat. The sounds of a harmonica played on shore were distinctly heard in the three receivers attached to the apparatus on the steamer, and singing, the sound of the human voice counting numerals, and ordinary conversation were audible. In the first tests it was found that conversation was not always distinct, but this defect was remedied by the introduction of more powerful batteries. A very interesting feature brought out during the tests mentioned was found in the capability of this form of apparatus to send simultaneous messages from a central distributing station over a very wide territory.

Extensive experiments in wireless telephony have also been made by Prof. A. Frederick Collins, an electrical engineer of Philadelphia, whose system differs only in minor details from that introduced by Mr. Stubblefield. In the Collins system, instead of utilizing steel rods, small zinc-wire screens are buried in the earth, one at the sending and another at the receiving station. A single wire connects the screen with the transmitting and receiving apparatus, mounted on a tripod immediately over the shallow hole in which the screen is stationed. With the Collins system communication has been maintained between various parts of a large modern office building, and messages have been transmitted without wires across the Delaware River at Philadelphia, a distance of over a mile.

Subsidence of the Texas Oil Wells.

Oil has now ceased to flow spontaneously from the wells of Beaumont, but the refiners are not thereby in any way disturbed. There is plenty of oil left in the fields, but it will now be necessary to force it from the ground. The startling flow of oil which greeted the man who made the first strike was due primarily to the enormous pressure of the gas confined in the same subterranean chamber with the oil. Since the chamber was penetrated the gas began to escape and the flow of oil to subside. Instead of natural gas pressure it will now be necessary to use artificial air pressure.

Scientific American Paris Exposition Award.

The exhibit made by the SCIENTIFIC AMERICAN at the Paris Exposition in Group 3, Class 13 of American journals and periodical publications, has received a Grand Prix diploma.

PASSENGER ON VESSEL COMMUNICATING WITH LAND.

RECEIVING A MESSAGE.

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Correspondence.

Bicycling Problem.

To the Editor of the Scientific American:

I have been riding bicycles of various kinds for fifteen or twenty years, and now I believe I have discovered why beginners on a wheel invariably run into any object they may wish to avoid. My wife is just learning to ride, and my opportunities for observation have suddenly widened; but it was while riding alone that I found what seemed to me to be a rational explanation of what has been always more of a joke than a serious matter.

On approaching an object which is to be avoided, a person instinctively leans away from it as far as possible; and to preserve the balance the bicycle must be tipped toward the obstacle. This inclination, alone, of the wheel will cause it to work in the wrong direction; but more than that, if the person straightens up ever so little—and it is hard to sit long at such an angle—he will, unless he is expert, throw the center of gravity of combined wheel and man over on the other side from the one on which he was leaning, so that the front wheel must be turned, sending him in the very direction he wished to avoid. As a result, the now frightened person probably leans still farther away and the whole process is repeated, sending him straight into the very obstacle he wished to clear.

This theory occurred to me, while riding on a narrow walk in a high transverse wind. I found myself leaning into the wind as far as possible, as though to brace myself, with the result that at the first unconscious effort to straighten up, I went off the sidewalk. I resolved then to relearn bicycle riding, and thereafter to try leaning the other way.

Perhaps there is nothing new in this idea, but if there is, it may be of interest to you.

Edward G. Maul,
Instructor in Mechanics, Rock Island High School, Rock Island, Ill., May 1, 1902.

Motors and Alcohol in Germany.

M. E. Mayer made a communication recently to the Wurtemburg section of the German Engineers' Association relating to the consumption of an alcohol motor. A society has been formed in Germany with a view of encouraging the use of alcohol in industrial applications, and this society has engaged itself to furnish, under certain conditions, alcohol at 90 per cent for the average price of $4.55 per hectoliter (26.4 gallons), which makes the price per kilogramme equal to .054 cent. It is found that 1 kilogramme of alcohol produces 6,000 calories, while a kilogramme of petroleum, costing .0506 cent gives 10,000. According to the calculations, therefore, the use of alcohol seems less favorable by 80 per cent. In the practical tests with a motor of 14 horse power it was shown that an alcohol motor only consumes 68 per cent of the heat units needed in a petroleum motor to produce the same power. The reason lies in the amount of water contained in the alcohol which gives a less abrupt expansion and also permits a higher compression, and thus gives a more advantageous utilization of the heat. According to the latest trials, the cost of the alcohol was but 22 per cent higher than that of petroleum for a given power. This is partly due to the fact that the society has recently lowered the price of alcohol to $3.50 per car load of 5,000 kilogrammes (11,000 pounds).

The Current Supplement.

An important geological article on the Dinosaur beds of the Grand River Valley of Colorado opens the current Supplement, No. 1377. Our new colonial possessions in the Pacific have received no little attention in two entertaining articles, the one on the vegetable products of the Hawaiian Islands, and the other on the weights and measures used in the Philippines. William A. Del Mar presents a very thorough and fully illustrated account of the making and testing of incandescent lamps. The article is very explicit and clear in every respect. A concise and yet complete resume of electro-chemical products is made the subject of an article by Samuel Sheldon. The making of borax is a subject that will probably be of interest to technological readers; so will articles on lac and the art of lacquering, and artificial silk. Selected formulæ, trade notes and consular notes will also be found in the Supplement.

An adequate idea of the high value of a modern Atlantic liner may be gathered from the fact that the insurance value of the North German Lloyd steamship "Kaiser Wilhelm II.," now in course of construction at the Vulcan shipyard, Stettin, is $1,591,150. This represents only the launching value of the bare hull. A further insurance sum of $3,549,480 is required to cover the ship for the first trial trip, while the company require a total sum underwritten on completion of the vessel of $6,175,000. The risk of launching, river work and trials is to be covered by the policies.

Engineering Notes.

About 3,100 miles of narrow-gage railroad are to be built in Spain at a cost of $50,000,000. The scheme is one of the greatest that Spanish statesmen have devised to secure better transportation facilities. Spain's inadequate railway facilities are due not so much to the indolence of her people as to the topographical formation of the country. The mountains offer an obstacle to railway building; and the rivers are too small and swift for many steamers. Freight and passenger rates are high. About 3½ cents per mile is charged for 400 miles. The speed of passenger express trains never exceeds 27 miles per hour. Ordinary trains never make more than 15 to 20 miles an hour. So costly is freight transportation that it is cheaper to carry goods from England to Spain than it is to ship them from Saragossa to Barcelona.

The United States Mint gives in exchange gold coin for gold bullion, no charge being made for the coinage of the bullion; but a charge is made for the copper added in making an alloy of the proper standard, or 900 fine, that being the fineness of both gold and silver coin, says The Mining and Scientific Press. All unrefined gold bullion, unless it be foreign coin, must be refined or parted, for which a charge is made in accordance with the fineness of the metal. Upon fine gold—that is, bullion over 990 fine in gold—no parting or refining charge is made. Seigniorage is the actual difference between the face value of the coin and the market price of the metal in the coin. As the market price of the gold in a gold coin equals its face value, there is no seigniorage upon the coinage of gold. In all United States silver coins it is different. In the silver dollar, containing 412½ grains of metal, 371¼ grains of which is pure silver, if the market price of an ounce (480 grains) of silver is 60 cents, and the government puts in the dollar 371¼ grains of silver, then the difference between the market value of 371¼ grains of silver and the amount of silver which the dollar will purchase is the seigniorage.

A special writer for Leslie's Weekly recounts in a recent issue some of the observations he made while traveling over the Trans-Siberian Railroad. He says the road has been engineered so that it runs through the richest part of the territory. The name Siberia stands for all the Asiatic dominions of Russia except Transcaucasia, Transcaspia and Turkestan. It is at present divided into the following provinces: Western Siberia, including the governments of Tobolsk and Tomsk, in the basin of the Ob River. Its area is 42,000 square geographical miles. The southern part of these regions, lying immediately east of the Urals, stretches far south toward the Khirgiz Steppe Borderland and the region known as Baraba. Over an area twice as large as Japan, this vast Siberian plain is composed of black earth and has scarcely a rock or stone. This black earth, or chernoziom, is the real treasure of Siberia, and makes the western plain the granary of Russia. Wheat, rye, oats and barley are grown in large quantities; crops of many fold were reaped last year. The two things that militate against the crops are the late frosts and the want of snow in winter. But when riding through the wheat fields in June the land seemed as rich and prosperous as Dakota. For hundreds of miles, even up as far north as Tobolsk, at fifty-nine degrees, nothing but grain fields growing green were seen. Winter wheat is seldom sown, but spring wheat is sown from April 10. Frosts in the wheat area generally begin in September. The land is tilled by the fallow-land system.

For some time past the comparative shallow depth of the water at the various ports of the sea of Azoff has attracted the serious attention of the Russian government. First class steamers cannot secure proper accommodation, with the result that cargoes have to be unloaded by lighters, thus incurring great expense and delay. The Straits of Kertch are only about 45 feet in depth; at Tagonrog the depth is only 7 feet 6 inches, while Marignople is inaccessible owing to a great sandbank, which reduces the depth of water to about 5 feet at the maximum. The Russian government has sought to overcome the difficulty by dredging the various ports, but the results achieved are disappointing. The authorities now propose to construct a barrage across the Straits of Kertch, thus raising the water level of the Sea of Azoff. The width of the straits between the Crimean shore, and the Tusla promontory is 10,823 feet, but of this total width only a little over 4,000 feet, giving an average depth of 27 feet, can be utilized. The construction of an embankment 51,480 feet in length is now contemplated, which will provide several large central basins with sufficient depth of water to accommodate large first class steamers. The total cost of the scheme is estimated at 9,800,000 roubles, approximately one-third of which will be expended as compensation to private individuals. The authorities propose to recoup themselves, however, by the levy of dues upon all ships passing through the straits. The completion of such a scheme will tend materially to increase the shipping traffic with the Azoff ports.

Electrical Notes.

At the meeting of the American Institute of Electrical Engineers to be held at Great Barrington from June 18 to 21, it is said that Marconi will for the first time make inland long-distance wireless telegraphic tests. The tests will be made on the second day of the convention. Besides Marconi, Tesla and Edison are expected to be guests of the Institute.

The retardation or load coils invented by Prof. M. I. Pupin and described in the Scientific American have been put into practical use on a line of about 1,000 miles in length. Three long-distance lines between Chicago and New York have been fitted with the load coils. It is said that the loudness of transmission has been increased by about a hundred per cent. Prof. Pupin hopes that by the use of his coils it will soon be possible to carry on a conversation between New York and San Francisco.

The bids opened by Gen. Greely, Chief Signal Officer, for wireless telegraphy systems to be used by the United States government in Alaska, have called forth tenders from six firms. Among the bids comes one from Germany for the Slaby-Arco system. The other bidders were the Marconi Company of London, England; Foote, Pierson & Co., New York; the American Wireless Telegraph and Telephone Company, of Philadelphia; the De Forest Wireless Telegraph Company, of New York, and Queen & Co., of Philadelphia.

M. Abraham, in an article on the theory of the propagation of electric waves along wires in Annalen der Physik, distinguishes two cases, in the first of which the return current is a pure conduction current, and in the second of which displacement currents also come into action. Ordinary telegraphy and telephony belong to the first category, and space telegraphy to the second. In oscillations of the Hertzian order it depends upon the distance between parallel conductors whether dielectric return currents come into play. The author discusses the relation between the conditions of propagation and the electromagnetic energy of the waves. He proves, among other theorems, that in stationary electromagnetic oscillations in a field bordered partly by perfect reflecting surfaces, while through the remainder plane homogeneous waves import and export energy, the mean magnetic energy equals the mean electrical energy. In the case of wire waves, the effective and apparent internal inductances are identical, and when the return circuit is metallic, and, therefore, the values of the apparent capacity and apparent external inductance are real, these values are identical with the values of the effective capacity and the effective external inductance derived from the field energy.

A simple instrument has been tried experimentally on the government telephone exchange in Stockholm for about a year, to indicate to the subscriber whether the operator is listening to the conversation. Bridged across the subscriber's line and connected to it by a double pole switch is a current detecter whose middle point is earthed. The center point of the operator's receiver at the exchange is earthed through the "engaged-test battery" in the ordinary manner. Thus, when the operator switches in her telephone through her listening key, a current is sent over both lines in parallel, through the above-mentioned subscriber's indicator, and to earth, and the subscriber knows that the telephone operator is on the line. The indicator itself has two astatic needles, on whose common axis an aluminium disk is placed with red, black and white crosses painted upon it. This disk moves behind a black painted shutter. When any current is passing through the indicator the black cross is behind a cut of corresponding shape in the shutter, and when the operator is listening, the red or white cross shows. In this way, when the communication is through two exchanges, the connections can be so arranged that the white cross indicates that the operator at one exchange is listening, and the red cross that the operator at the other exchange is in circuit. This instrument is said to have worked well on the Stockholm system and to have been popular among subscribers.

German Substitute for Petroleum.

Consul Worman reports from Munich that, according to the newspapers, a Hamburg chemist has discovered a fluid which, when added to ordinary water, produces a liquid that cannot be distinguished from petroleum. It can be used for lighting as well as for heating purposes. When burned in a lamp with an ordinary wick, it gives an extraordinary white light of double the strength of a petroleum flame. The fluid is not explosive. A company, it is said, has been formed in London for the exploitation of this discovery. In our opinion, the exceptional efficiency of this mysterious liquid must be taken with a pinch of salt.

The new Edison storage battery is now on the market commercially. It has been officially announced that the plant for its manufacture at Silver Lake, N. J., has been completed and that the company is ready to take orders.

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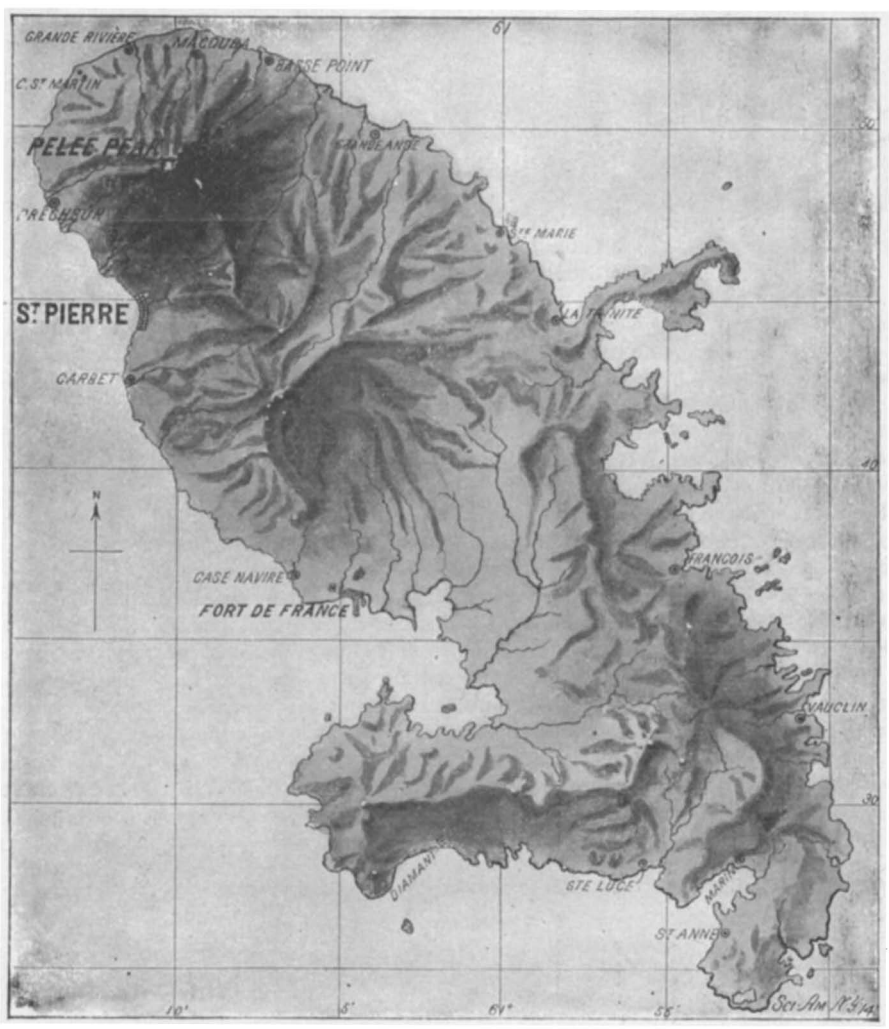
THE DISASTER IN THE WEST INDIES AND ITS EXPLANATION.

Now that we have in a measure recovered from the first shock of the West Indian disaster, our attention is turned from the appalling accounts of human destruction to the interesting details of the volcanic phenomena. It is a general rule that the intensity of an eruption is proportional to the volcano's quiescent period. For years the people of Martinique had lived in perfect safety under the shelter of Mont Pelée and they had lost all fear of danger. First warnings of impending danger began on May 3, when the volcano threw out dense clouds of smoke. During the next night these clouds reflected the glowing mass in the crater and rumbling noises were heard. Hot ashes covered the city of St. Pierre on the 4th; and at noon of the 5th a stream of boiling mud suddenly rushed down the mountain side to the sea. The speed of this flow far exceeded that of an express train; for it is said that the distance of five miles was covered in three minutes. This sudden rush caused the sea to recede some 300 feet and return in a tidal wave of considerable, though not serious, proportions. Cable communication with Martinique was interrupted in the afternoon of May 6, and the next news filled the world with horror. An entire city of 28,000 inhabitants had been literally wiped out of existence.

From the wild and exaggerated stories of the few survivors we gather the following details: Thursday, the 8th, at 7:50 A. M., there was a sudden, deafening explosion, and immediately the air was filled with hot sulphurous gases which withered everything they touched. It is said that the whole top of the mountain was blown off and fell in hot dust and shattered rock on the city, while mud and lava poured out of the opening thus made. An eye witness at Morne Rouge, a town 4½ miles away, which was not destroyed, states that there were seven luminous points on the side of the mountain, just before the volcano burst, and that the explosion was followed by ten minutes of absolute darkness. Simultaneously with this explosion a tidal wave tore the vessels in the harbor from their anchorages and wrecked them on the beach. The "Roddam," which had a full pressure of steam on, was the only vessel to escape total destruction, and she worked her way flaming from the harbor, amid a shower of molten matter. In the city almost the entire population was immediately suffocated by the hot, poisonous gases. This is proved from the fact that almost all the dead were found face downward with their hands covering their mouths. It is supposed that the destruction was the work of but a few seconds. The short duration of this intense heat is shown by the fact that delicate fabrics were found uninjured among the badly charred victims. The terrific force of the explosion tore up huge trees by their roots and laid them flat; heavy blocks of stone were scattered about; stone buildings were entirely destroyed. Debris covers the city for a depth of 12 feet. According to the present estimates the loss of life was almost equal to that resulting from the tidal wave which followed the eruption at Krakatoa, when 36,000 people perished.



The Island of Martinique, Showing the Location of the Volcano, the Ruined Town of St. Pierre, and Fort de France, in which the Survivors are Gathered.

As yet few facts are obtainable of the eruption of Mt. Soufrière, St. Vincent, which occurred on the 9th of May. A large loss of life is reported and dust from the volcano spread over the Barbadoes Islands, 75 miles to the east. This eruption had probably a sympathetic connection with that of Mont Pelée. The topographical changes occasioned by these two volcanoes cannot be accurately given at present, because of the lack of exact scientific data. It is reported, however, that Mont Pelée, which was previously 4,528 feet high, has now considerably less elevation. Rivers that were obstructed have overflowed their banks, causing floods and landslides. Important submarine changes have also taken place, for in grappling for the broken cable off St. Pierre, the cable ship "Poyer Quertier" reports that she found the sea bottom 4,000 feet below the surface of the water, where formerly the depth was but a thousand feet. These changes may result in disaster to shipping until properly recorded by hydrographic survey.

Volcanic eruptions are generally attributed to the expansion of moisture in the heated subterranean rocks. The original theory that the earth is a liquid mass, covered by a thin crust of solid matter is now entirely discarded by scientists. Such conditions would seriously interfere with the rotation of the earth and the stability of the crust. We know the effect of the moon's and sun's attraction on the thin skin of ocean that covers the surface of our globe. Tidal waves are continually sweeping around the earth in a direction contrary to the earth's rotation. In comparison with this we can easily see what a tremendous drag to the rotation of the earth would result were the entire earth a liquid mass covered by a mere shell of solid matter. Scientists tell us that the wave produced would be so powerful as to make even a solid steel crust of 300 miles of thickness yield like India rubber to its deforming influences. The theory of a molten interior was based on the observation of volcanoes and on the fact that the temperature of the earth increases on the average one degree for every fifty feet of descent from the surface. Following this theory come others, in which the earth is supposed to have a solid core and an outer crust, between which is a layer of liquid material. Any displacement of the crust covering this liquid layer, whether resulting from contraction of the earth or other causes, would force the lava to the surface through the weakest spot. In refutation of this argument the conditions at Hawaii might be considered. The crater of Mauna Loa is 13,650 feet above the sea level, and that of Kilauea is 4,040 feet. These mountains are not over 35 miles apart and yet both are filled with lava. How could such varying levels be maintained, if both craters were fed from the same source? This query has forced many to believe that the liquid matter was contained in local, vesicular spaces beneath the crust. Both of these theories were brought forth to reconcile the requirements of physics with those of geology, which called for the existence of fluid matter at a small depth from the surface of the earth. At present geologists have pretty generally discarded these theories as unnecessary; for it is claimed that the powerful pressure due to the earth's contraction would prevent material from attaining a liquid form. Immediately on release of this powerful pressure, however, the matter would become fluid and pour out of the mountain in the form of lava. As stated above, the power which causes the upheaval is attributed to the expansion of imprisoned vapor. From the fact that volcanoes are usually found near the sea, it was at first argued that the water oozed down into the heated regions, either of its own weight or by capillary attraction. Many scientists think this theory to be absurd, for they argue that it would be impossible for the water to enter a region under such compression, also that long before reaching a sufficient depth it would be turned into steam and forced back through the very channels by which it entered. The most plausible theory, and one now pretty generally accepted, accounts for the presence of water in heated rocks as having occurred during their crystallization period. These rocks, in the course of time, were deposited in the sea by the action of rivers. After many ages, the water-bearing rocks are covered to a great depth under layers or "blankets" of deposited matter, and the heat there encountered finally brings the water to a sufficient tension to cause an explosion.

For months after the eruption of Krakatoa red sunsets were seen all over the world, and were attributed to the volcanic dust thrown into the air. This fine dust, commonly called ashes, is merely the rock which is shattered and pulverized by the force of the explosion. In all probability the same phenomenon will follow the West Indian eruptions and in the course of a month red sunsets should be seen in New York. As in the case of the Krakatoa eruption, the dust will probably travel toward the east, following the upper currents of the air which flow in a direction opposite to that of the trade winds.

A marked series of seismic and volcanic disturbances are now occurring over a wide region, but whether these are in any way connected with the eruption of Mont Pelée is merely a matter of conjecture. We have already shown that the volcanoes in Hawaii are not connected, though they are very close together, and we may look upon this series of disturbances merely as a coincidence; for one would suppose that the other volcanoes in the West Indies would be active before the more distant volcanoes of Central America. According to precedent, Mont Pelée should continue in activity for a long period, her eruptions growing weaker and weaker as years pass by. What future changes will result from this disturbance it is hard to tell. Considerable light will shortly be thrown on the situation by the large body of scientists who are already flocking to the scene of the disaster. A short description of the unfortunate island might be of interest. Martinique has an area of 381 square miles and a population of about 190,000, of which number about 5,000 are laborers brought from India and over 5,000 laborers from Africa; also about 500 Chinese immigrants. The remainder of the population is largely native negroes, the white population numbering in all about 10,000. A large share of the interior of the island has never been brought under cultivation, although it has been occupied by the French almost constantly since 1636, a period of 267 years, the only interruption in French control being the period from 1794 to 1802, when the island was held by the British. Slavery existed until 1848, when it was abolished in this as well as other French colonies. Notwithstanding the fact that a large part of its interior has never been brought under cultivation, the island is described by Reclus as "one of the most densely populated spots on the globe; on the arable islands people are packed as closely as in such industrial centers as Lancashire, Flanders, or Saxony."

Mount Etna Railroad.

The circular railway which passes around Mount Etna is interesting on account of the geological conditions encountered in its construction as well as the nature of the country which it passes through. In many points of the route the surface consists of layers of lava, and more than twenty-two miles of cutting had to be made across the lava, which is hard as granite. In this way the line, which is only 70 miles long, required no less than four years to execute. The road leaves the station of Borgo and mounts first across a region of flourishing vegetation, among vineyards, wheat fields and orange orchards, but soon it enters an arid and treeless portion, and runs between hillocks of lava until it reaches a fertile strip at Belpasso, a district which suffered greatly from the eruption of 1669. The road again passes through the small town of Misterbianco, which was destroyed by the same eruption, and reaches Paterno, with its miniature volcanoes, which throw out salt mud, and its ferruginous springs. Farther on is Aderno, which has a waterfall and a river, two things which are quite rare in Sicily. Then the route passes through Bronte, which has been often threatened with destruction by lava, and was especially in danger in 1832 and 1843. The last station is Giarre-Riposto, from which it is easy to reach Messina or Catania. This road will be very much appreciated by tourists, and will also serve as an outlet for the products of this populous region.

The art of making malleable glass, which is said to have been well understood by the Egyptians, but which has been for centuries lost, has been rediscovered by Louis Kauffeld, of Richmond, Ind., so the daily press says. Mr. Kauffeld is a lamp chimney maker, and has for years tried to devise a chimney that would withstand excessive heat. The new process, it is stated, renders possible the making of cooking vessels out of glass.

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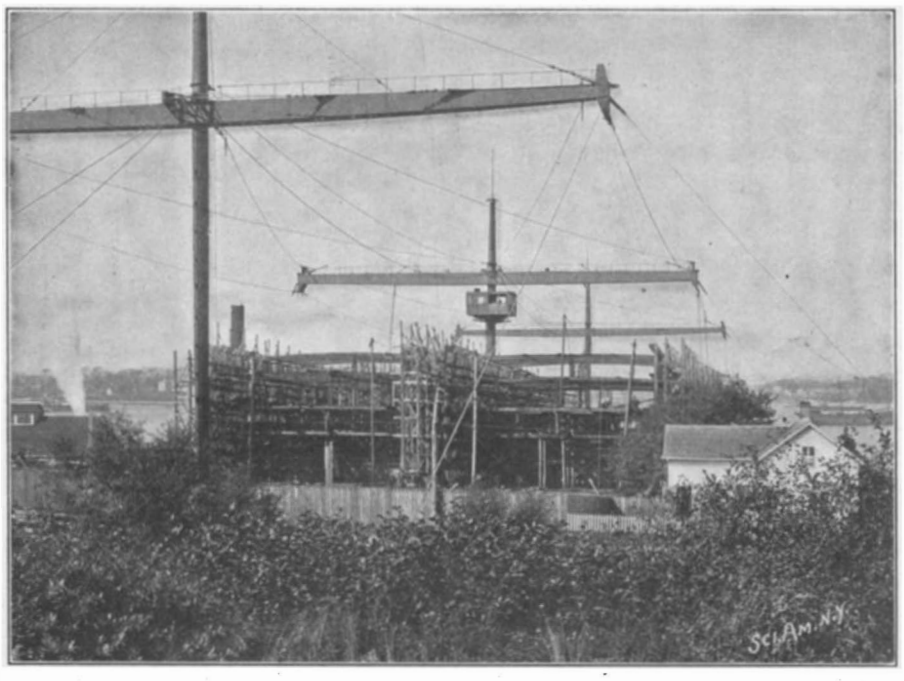
HANDLING MATERIAL IN SHIPYARDS.

BY WALDON FAWCETT.

The problem of handling expeditiously and economically the various classes of material entering into the construction of the modern steel ship is one of the most perplexing which has been presented in connection with the industry, and one in the solution of which the American builders of metal vessels have expended much thought and experiment. The exigencies of the case are many. The material to be transported is almost invariably heavy and bulky; it must be carried long distances in a limited space of time, and as a rule it must be delivered at a point a considerable distance above the surface of the ground. Within the past year or two, however, American inventors have been particularly successful in evolving devices to meet these varied demands, and, in point of ingeniousness of appliances, the steel shipbuilding plants in the United States are now much better equipped than those on the other side of the Atlantic.

One of the most interesting installations of this character has lately been made at the newly established plant of the Eastern Shipbuilding Company, at New London, Conn., where there are now under construction for the Great Northern Railroad two of the largest and heaviest steamers ever built. The overhead trolley principle has been utilized, and the system consists of three vertical masts, each about 140 feet in height, erected between the two large ships mentioned, one mast being stationed at the sterns of the vessels, another at the bows, and the third at a point midway between the other two. Each terminal mast is about three hundred feet from the central support. To each of these masts, at a point about ninety feet from the ground, is affixed a large horizontal yard or crossbar of rectangular section about six feet square. The masts, which are of circular section, are embedded in foundations of great solidity, and are securely stayed in fore-and-aft directions by strong steel wire stays or guys, securely anchored in rock. To still further add to the rigidity of the after-mast, the water-end stay is supplemented by a steel strut or compression strong-back. To insure steadiness in the athwartship direction there are provided steel guys, similar to those forward and aft, and these, running from the ends of the yards, are also provided with rock anchorages.

The supports provided for the crossarms are equally efficient. Connecting the middle and end of each yard is a strong fore-and-aft steel wire stay, while running from the ends of each yard to the mast supporting it are diagonal wire-rope guys. The yards are supported from the mastheads by large steel-wire guys or lifts, and the two terminal yards are, in addition, braced and trussed with heavy wire-rope tension guys. Upon each of the crossyards is a track upon which travel cars which act as anchorages or supports for the great suspension cables which are strung from mast to mast. Upon these cables in turn travel the carriages which convey the material to any point between the masts. It will thus be seen that by utilizing the athwartship motion of the cars on the masts and the fore-and-aft motion of the carriages on the cables, it is possible to deliver material to any point within a rectangle 600 feet in length and 175 feet in width.



System of Masts, Yards, and Cable Lines as Used for Handling Material in Building the Two Great Steamships at New London.

Virtually any number of independent trolleys that the work may require may be suspended from mast to mast. For instance, as at present operated this system has four traveling trolleys, each having transverse and longitudinal motion, and at work simultaneously handling the heaviest pieces of material that enter into ship construction, whereas many of the forms of apparatus for handling material, heretofore in use, have a limitation to one or two simultaneous hoists.

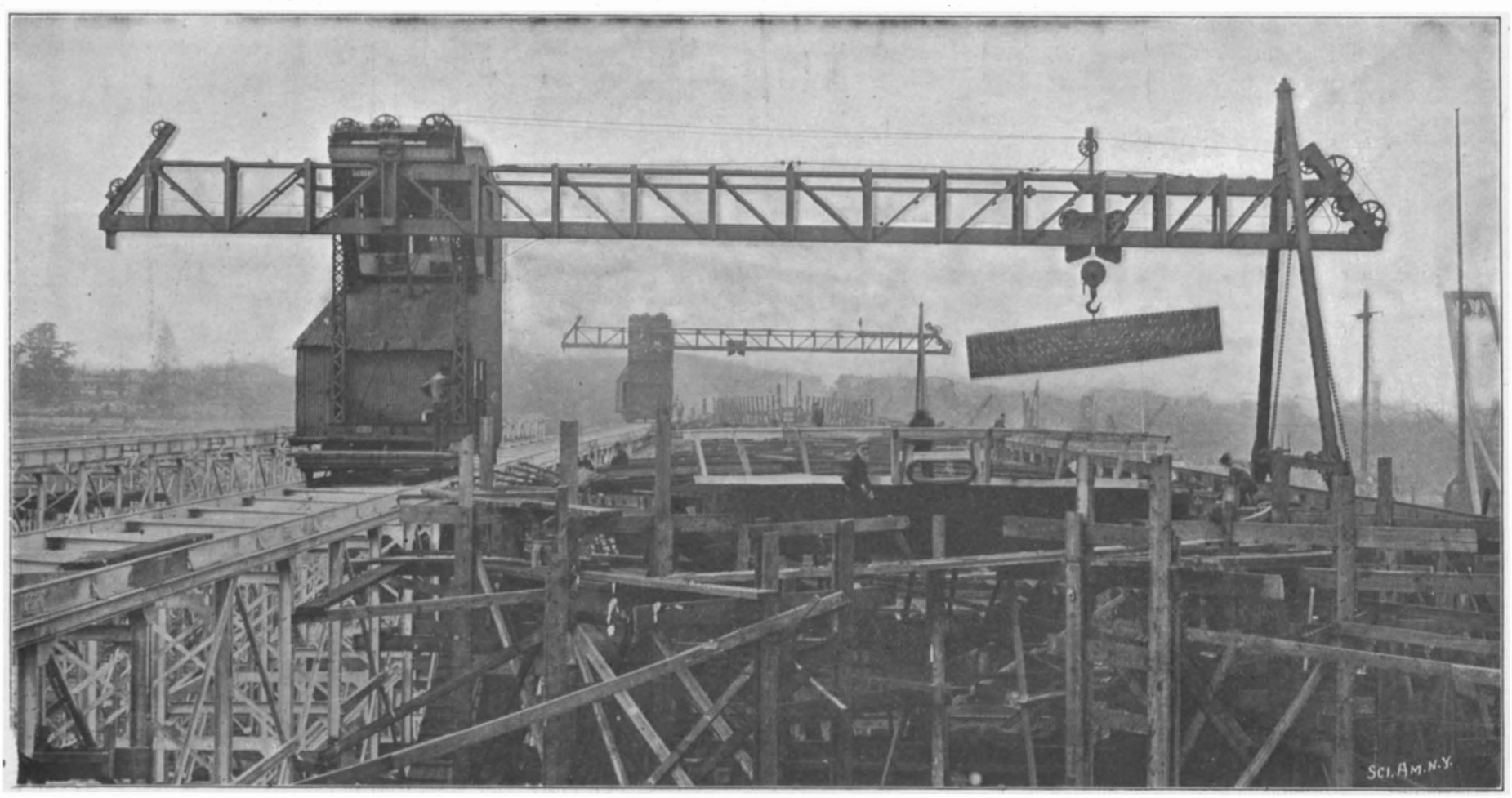
Both the cars on the crossarms and the trolley carriages on the cable spans are electrically operated, and each wire-rope carriage is provided with hoisting sheaves and all necessary attachments, so that plates, frames, beams, or other parts of the ship or construction members, may be picked up or lowered at any part of either ship. The operating station from which the entire system is controlled is located in a house supported by brackets on the central mast just below the crossarm. It may be noted that Prof. Von Halle, of Berlin, Germany, who recently made a study of American shipbuilding facilities, declared this overhead system of handling material to be "the great feature of the most remarkable shipyard in the world."

Another unique installation for handling shipbuilding material—like that at New London original in design—was employed in the construction of the immense floating drydock recently delivered to the United States government by the Maryland Steel Company, of Sparrow's Point, Md. This consists of a number of derrick cranes, or "locomotive derricks," as they have been termed. The latter designation is undoubtedly due to the presence of points of similarity between this new type of derrick and the familiar locomotive crane.

The derricks constructed by the Maryland Steel Company travel on standard-gage railroad track, and may thus be quickly transferred from one part of the yard to another, a track having been placed between every pair of building ways. The derrick consists of a skeleton steel structure, from which on opposite sides project slender steel arms to which are attached hoisting apparatus of the ordinary type. By the raising and lowering of these arms, for which operation power is supplied by a steam engine situated on the car-like structure which forms the base of the derrick, it is possible to elevate a load of ten tons or more to a height of from sixty to seventy-five feet, placing the ship plates or other material in the exact position desired on the side of the vessel under construction.

Another innovation of the new century in the handling of shipbuilding material is to be found at the new yard of the Fore River Ship and Engine Company, at Quincy, Mass. In this case a distinct advance has been made over the heretofore most generally accepted form of apparatus of this class, namely, the cantilever crane mounted upon an elevated track between two building berths, thereby allowing the crane to command two ships. At the Fore River Company's plant there has been erected over the berths an immense steel-framed structure of sufficient size to accommodate under its truss roof and projecting wings two battleships and two merchant vessels of the largest size. Longitudinal lines of girders are secured to the under side of the roof trusses of the frame, and these girders form tracks for electric cranes, each of five tons capacity.

The great advantage of the system is found in the independent action of the cranes. Two cranes are assigned to each building berth, and it is practicable to proceed with the construction of four ships simultaneously, with no possibility that an accident to a crane would entail a complete suspension of operations, as is necessary where two vessels are dependent for their supply of material upon a single



A Pair of Overhead Traveling Cranes.

HANDLING MATERIAL IN SHIPYARDS.

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cantilever crane. By utilizing two of the cranes, loads of ten tons may be transported with ease.

M. Vignon's Researches and the "Holy Shroud."

At a meeting of the Paris Academy of Sciences on April 21, some remarkable photographs of brownish stains found on the "Holy Shroud" kept in the Treasure Chamber of Turin Cathedral, and traditionally said to be the winding-sheet of Christ, were exhibited in connection with a paper by Dr. P. Vignon. Upon reproducing these stains by photography, Dr. Vignon found that he obtained a realistic picture of a human figure, and the suggestion is that the picture is actually a representation of the body of Christ, produced by radiographic action from the body, which, according to ancient texts, was wrapped in a shroud impregnated with a mixture of oil and aloes.

In his paper published in Comptes Rendus, Dr. Vignon remarked:

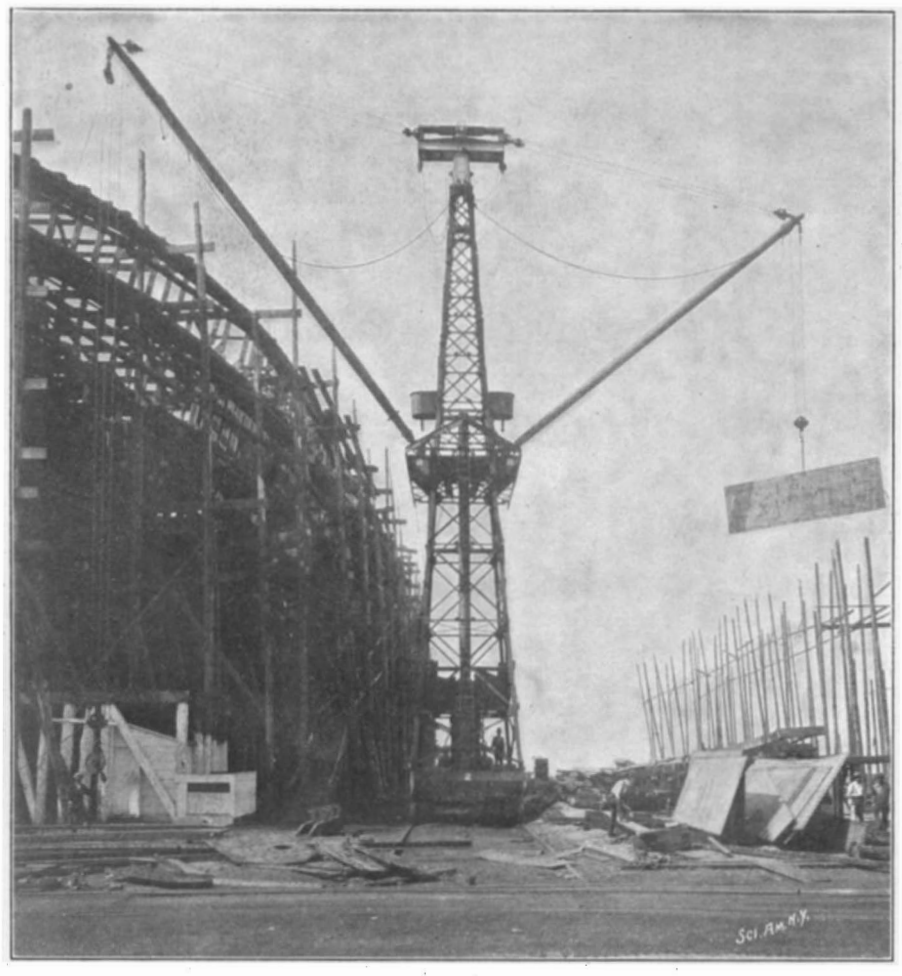
"It is known from the work of M. Colson, published in the Comptes Rendus of the Academy of Sciences in 1896, that freshly cleaned zinc emits vapors at the ordinary temperature which are capable of affecting photographic plates in the dark. The researches of Russell have also shown that the striations of a plate of zinc are reproduced on a photographic plate. But it is a long step from this to the realization of an object in relief. I have succeeded in obtaining images either with medals powdered with zinc, or with bass-reliefs or objects fully embossed in plaster, and rubbed with zinc powder. These images are negatives, not by the inversion of light and shade, since they are formed in the dark, but by the fact that the reliefs give more energetic impressions than the cavities. To interpret these it is necessary then to invert photographically; positive images are then obtained in which the scale of relief is scrupulously respected, which is far from being the case in normal photographs of the same objects illuminated from the front. Naturally, upon images made at a distance, the reproduction of the most minute details could not be expected, the precision of the detail obtained being less at the distance increased. The clearness of the image depends upon the rapidity with which the action diminishes when the space increases between the emissive surface and the receiving screen.

"From a point of the active surface let a perpendicular be lowered onto the receiving plate; the foot of this perpendicular constitutes the center of a circle which makes a more energetic impression in its central region than on its edges; the clearness of the image will thus be greater the smaller the surface of the circle acted upon, and this surface varies inversely as the rapidity with which the actions decrease when the distance increases. It is on this account that the images correspond very nearly to those which would be realized if the actions were produced only according to the orthogonal projections of the different points of the active surface.

"It is a curious point that the images converted into positives frequently give rise to the impression of having been lit from above.

"This will be the case when a plane, such as the forehead, is seen from the front and forms at the same time a strong relief, while a plane near it is rapidly shifting, such as, for example, the region which connects the superciliary arch to the eyeball. When this plane shifts it appears to sink into a deep shadow.

"The truly specific character of these negative images which arise from action at a distance lies in the softness of the contours. The limit of the visible portion is the result for the eye of the receding of the surface. If this falling back takes place at a small distance from the receiving plane, the contour is still marked, though vaguely; but if this falling away is produced only at a distance greater than that at which the vapors can act, no corresponding effect is produced in the image, which gradually weakens up to its borders by insensible gradations until it disappears altogether. Practically in spite of the softness of the details and the outlines, the impressions produced by vapor are far from consisting of simple shadows; if the object is in strong relief, the image is energetic and well marked; it appears simply as if the object were seen through transparent gauze, or as if it had half emerged from a fog.



Locomotive Derrick Crane With Two Booms.

"Negative images have also been obtained by acting with ammoniacal vapors upon cloths impregnated with a mixture of powdered aloes and olive oil; it is known that aloes contains a principle which turns brown and is oxidized under the influence of alkalies in moist air. A plaster hand covered with a suede glove which has been moistened with a solution of ammonium carbonate acts similarly. There is obtained in this way a sort of print of the hand, a negative softened at the edges and wanting in proportion in so far that the points where the hand is too far from the cloth are too faint, the points of contact of the hand and cloth, on the other hand, being too strongly marked. The fermentation of urea, easily brought about by the addition of a little urine, leads to the formation of ammonium carbonate and thus causes the browning of the aloes. The fermentation of a febrile sweat, rich in urea, leads to the same result, as is already well known."

The extension of Dr. Russell's researches on the photographic activity of certain bodies in the dark, contained in the above paper communicated to the Paris Academy by M. Vignon, has given rise to a most curious discussion, says Nature.

There is a so-called "Holy Shroud" at Turin in which tradition states the body of Christ was wrapped after the Crucifixion. An article in the Times thus refers to it and its connection with M. Vignon's work:

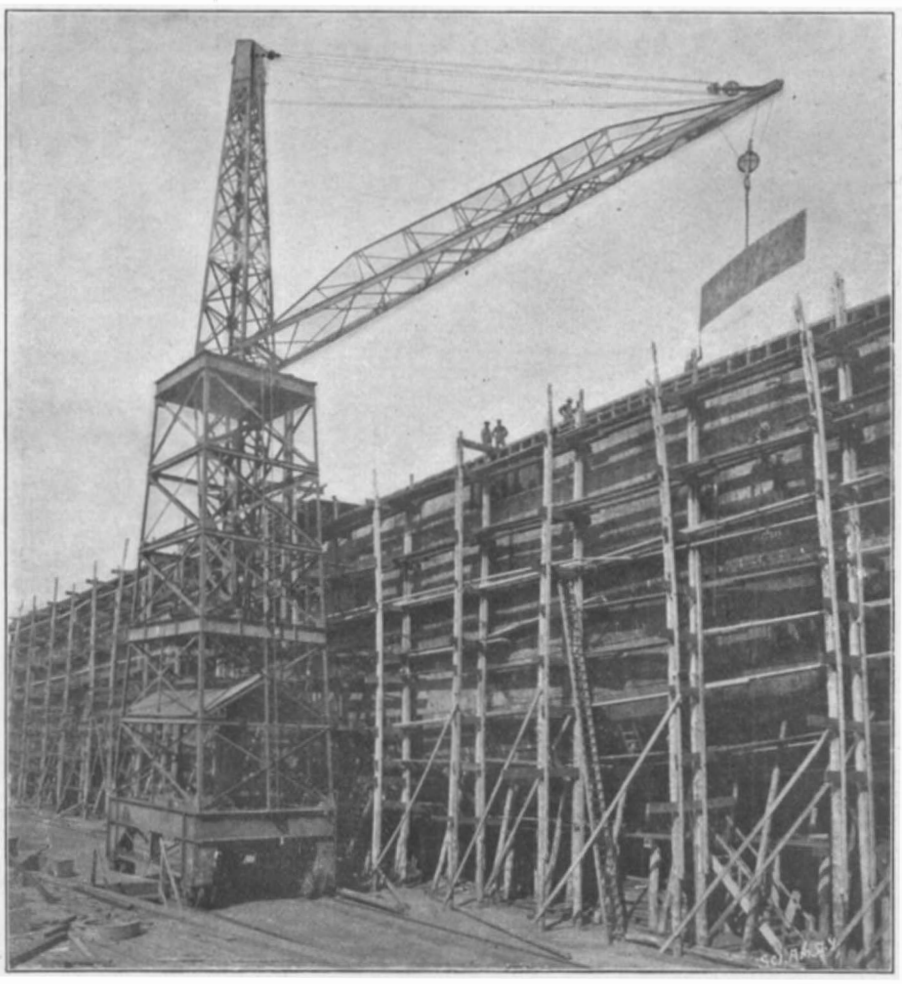
"It is said to have been brought from the East in the fourteenth century, and in the following century it passed into the hands of the House of Savoy, and was deposited at Chambery. Finally, it was transferred in 1578 to its present resting-place by Duke Emmanuel Philibert, who wished to spare Carlo Borromeo, the sainted Archbishop of Milan, the fatigue of a pilgrimage to its distant Savoyard shrine. The Shroud bears upon it, traced in hues of brown, what is alleged to be a double impression of the figure of Our Lord, the outlines both of the face and back of which have reproduced themselves with wonderfully distinct exactness. So seldom, however, is it exposed to view that this remarkable characteristic had almost been forgotten when, in May, 1898, some photographs specially taken of it by Signor Secondo Pia, of Turin, with the consent of its possessor, the King of Italy, once more drew attention to this strangely living likeness. Eighteen months ago these photographs came under the notice of M. Vignon, who, recognizing their exceptional importance, at once began that inquiry of which the results were made public in a paper communicated to the Académie des Sciences."

In Paris, therefore, it has been generally accepted that a demonstration has been given by science of the authenticity, not only of the so-called shroud, but of all the historical events connected with it, and a much closer rapprochement between science and theology is predicted for the future.

Here, however, difficulties have been raised. Father Thurston, a learned Jesuit, writes to the Times as follows:

"Before we can profitably discuss the value of Dr. Vignon's scientific explanation of the marks on the 'Holy Shroud' a serious difficulty of quite another order has to be cleared up. The Abbé Ulysse Chevalier claims to have proved to demonstration that the linen winding-sheet exhibited at Turin is a spurious relic manufactured in the fourteenth century, and, as the writer believes, with fraudulent intent. M. l'Abbé Chevalier is a scholar of distinction, and of his perfect loyalty to the Catholic Church there can be no possible question. Moreover, his essay ('Etude Critique sur l'Origine du S. Suaire,' Paris, Picard, 1900) has been warmly welcomed by the more critical journals devoted to hagiography. In the Bollandist periodical, the Analecta Bollandiana, for instance, its Jesuit editors state (vol. xix., 1900, p. 350) that the Abbé Chevalier's discussion of the subject is final, and that 'il ne reste plus qu'à proclamer "à haute et intelligible voix," comme le voulait le Pape Clément VII.: "Hæc figura . . . non est verum saudarium Domini Nostri Jesu Christi." '

"They go on to state that the story of the 'image of the shroud' given by Geoffroy de Lirey to the college founded by him in 1353 is not lost in the mist of ages, and does not happen to present any of those obscurities by which the historian who wishes to impart his own laboriously-acquired conviction to others must at times find himself baffled. We have, for instance, the document addressed to the Pope by Bishop Peter d'Arcis, in which he denounces the fraudulent dealing of the Chapter of Lirey, who for motives of avarice pretended that miracles were worked by this shroud,



Locomotive Derrick Crane with Single Boom of Latticed Steel Construction.

HANDLING MATERIALS IN SHIPYARDS.

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whereas his predecessor in the see of Troyes had officially investigated the matter and proved it to be a forgery. 'Et probatum fuit eciam per artificem qui illum (pannum) depinxerat, ipsum humano opere factum, non miraculose confectum vel concessum.'"

There is also another difficulty. It is stated that there is at least one other Holy Shroud in another holy place.

QUEER CHINESE TREES.

BY ISAAC TAYLOR HEADLAND.

"Queer, aren't they?" said one of the party as they noticed the tree in the illustration. "Who's queer?" asked the little man with the short legs and large head. "The Chinese." "Why?" "Look at that tree."

The tree was of special interest to the little man, as he was collecting information about all kinds of queer growths of Chinese trees and flowers.

"No, not queer, just Chinesey," he replied.

The tree is an ordinary evergreen. It had been split up from the roots about six feet when a small sapling, the roots having been carefully divided, and thus planted in front of the temple. The two halves were placed three feet apart, each having the same curve to the place where they joined, from which point it grew in its natural form. It was placed directly in front of the door of the temple, between the door and the gate of the court, ten feet from the gate and thirty feet from the door, as though it was designed that the worshiper would pass through the tree before entering the temple.

Thus far we have discovered only six of these trees. Four are in the north end of the Forbidden City, in front of two of the temples. The one in the illustration is before the temple in the winter palace, where Count von Waldersee's troops were stationed, and the third is in a similar position in the summer palace. Whether this particular kind of tree is confined to imperial grounds we cannot say, but thus far we have seen none in other localities.

The Chinese are fond of wrapping or braiding two, three or four sprouts of a tree together, and allowing them to grow in that form. In the campus of the Peking University there was a species of locust, which they call the *Huai shu*, and which, by the way, is the best shade tree of North China, the two sprouts of which had been wrapped together when small, and when sawed down by the Boxers they were each six inches in diameter.

Only a short distance from where the writer is now sitting is an apricot tree on which is an abundance of fruit. It consists of four sprouts which have been neatly formed into a braid and have continued to grow until they are each three inches in diameter.

A favorite decoration for lawns or courts is made from this locust. The top of the tree is cut off and the root of another the same size grafted thereon. The roots thus become branches, which grow downward instead of upward, and are covered with a dense foliage. This species of shrub is very common and familiar to all landscape gardeners.

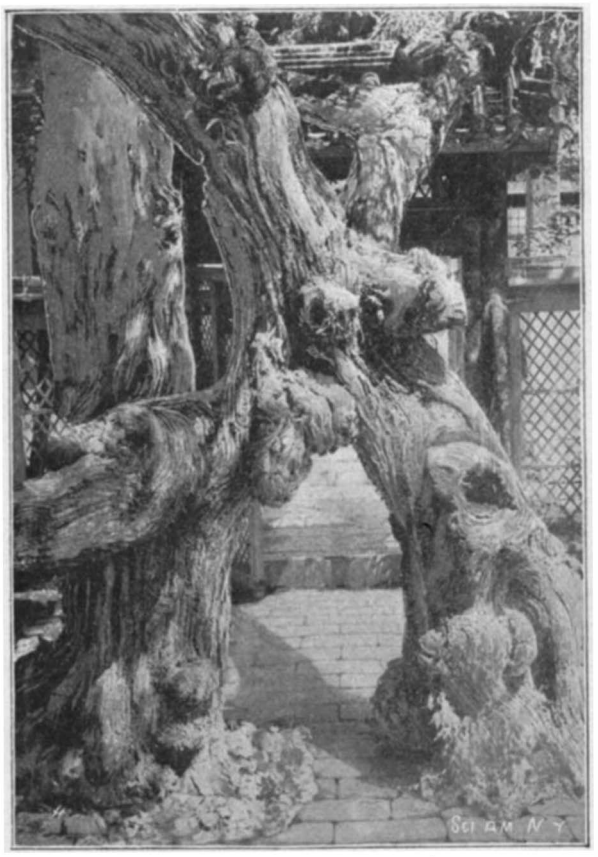
A very interesting and attractive flowering shrub is called *Kan-chieh-mei*. It is a species of plum, is used as a pot plant and grows two or three feet high. Every branch is bent or broken in as many ways as possible to bring them all close together, so that when it blooms—which it does before it leaves—it is a mass of flowers.

Perhaps the most attractive specimen of Chinese plant cultivation is the grafting of the chrysanthemum. They have a large, common weed called *hao tze*. In the early summer they cut the branches off this weed and in the place of each branch, as well as on the top, they graft a chrysanthemum stalk. The root of this weed is much stronger than the root of the flower, so that when they bloom the flowers are double as large as the ordinary chrysanthemum, and in addition to this extra luxuriance of blossom, all varieties of color appear on the same stalk. Blooming as they do in midwinter, they are very attractive.

It goes without saying that a people who thus understand the grafting of flowers are not ignorant of any of the processes of budding, grafting or crossing fruit; as a result we are able to obtain very fine specimens, especially of the peach.

Carbureted Acetylene.

A departure which may turn out to be of some importance to the automobile industry, is described in a paper read by Dr. N. Caro, of Berlin, before the German Acetylene Verein at a meeting held at Eisenach. It appears from Dr. Caro's contribution that acetylene gas, when led through petrol, becomes heavily carbureted by it in much the same way as does ordinary atmospheric air. 100 liters of acetylene will in this way take up 125 grains of petrol, yielding 150 liters of carbureted gas. As a heating agent the carbureted acetylene is superior to ordinary acetylene in the proportion of about 6 to 4. It is plain that we have here a gaseous mixture containing a high degree of energy. Should it turn out to be applicable to explosion engines it ought to enable motors of extreme power per unit of weight to be constructed. There may, of course, be practical difficulties in the way, and they have not altogether been satisfactorily got over yet in the case of acetylene gas alone, while the fact that there is a tendency for petrol vapor to separate out from the acetylene on cooling somewhat, may give rise to additional complication, but in any case the discovery is one of high importance, and possibly before long we may see it made practical use of in explosion motors.



A PECULIAR TREE GROWTH.

STORY OF THE FISHSKIN GARMENTS OF THE AMUR TRIBES OF EAST SIBERIA.

BY WALTER L. BEASLEY.

Among the new and striking exhibits of the Jesup North Pacific Expedition, just installed in the Anthropological Hall of the American Museum of Natural History, are a number of elaborately ornamented fishskin garments or dresses. These were collected by Dr. Berthold Laufer, who spent two years in gathering material to illustrate the life and customs of the various tribes of the Amur regions of East Siberia. One of the noteworthy results of these investigations is the bringing to light of a tribe of highly skilled and versatile artists, who, though living in a primitive state, being unable to read or write, and having no written or historical records, are yet masters of decorative art. Several hundred specimens of their household effects and wearing apparel, profusely ornamented with astonishing designs, display the wonderful character of their native handicraft, which is considered an independent branch of East Asiatic art, entirely different from that of other Siberian peoples. It was found that the Gold were the most talented representatives of the Amur tribes, possessing the best understanding of decorative art, and having the largest number of individual artists excelling all others in the proficiency of embroidery. The two fishskin dresses here pictured are the work of the women of this tribe. The original motives for all their designs and patterns are derived mostly from the cock and the fish. The fishskin dresses are worn exclusively by the women, and are highly ornamented with cut-out pieces of fishskin, generally colored blue. They are sewed with fishskin thread to a piece of fishskin adapted to the size and form of the ornament. The patterns are cut out by means of a long, sharp-pointed knife, as they do not possess scissors. The dress is composed of three layers of fishskin, the undermost representing the skin of the garment proper, the uppermost showing the ornaments in the cut-out form. Between these two layers is inserted a middle layer, which serves as a background to the ornament proper, throwing out distinctly the negative parts, as well as the outline of the ornament. On the left dress pictured are two neat naturalistic perching cocks, with trisulcate tails and open beaks. The bottom is occupied with a composition of conventionalized fishes and spirals. The garment on the right presents a different scheme of ornamentation and consists of three vertical rows, the two outer of which tally and are composed of three single figures each, while the middle series presents a coherent structure. The ornamental principle of this pattern is a pair of facing spirals in the middle; above and below them are two erect conventionalized bipartite fishes, and the whole is surrounded by a line corresponding to their form. A detailed study of the marvelous ornamental productions of this gifted tribe of Amur artisans would yield the American seeker after fresh and original designs for decorative purposes a rich field for selection. A splendidly illustrated memoir on the "Decorative Art of the Amur Tribes," by Dr. Berthold Laufer, has just been issued by the Museum.

TWO SIBERIAN FISHSKIN GARMENTS.

A Substitute for X-Rays.

Years ago Becquerel found that salts of the rare metal uranium possessed the power of throwing off a feeble and invisible radiance that affected photographic plates, like the X-rays. Mme. Curie in Paris last year isolated from the Bohemian mineral pitchblende two other elements that behave in the same manner, but are far more active. One of them she called "polonium" and other "radium." The latter is said to be one hundred thousand times as intense as uranium in its photographic effect.

Prof. Geo. F. Parker, of the University of Pennsylvania, has been experimenting with all three of these elements and with the mineral (pitchblende or uranite) from which the two new elements are derived. He recently exhibited a series of photographic plates on which impressions had been produced by these substances. His procedure has been as follows:

A photographic plate was inclosed in black paper and then covered with yellow paper. After one whole day's exposure to the sunlight no effect was produced. This precaution proved the thoroughness of the protection. Then the various metals and salts were placed outside the covering of the plate and they produced dark stains.

In order to take photographs of objects such as a hand or a foot these objects would be placed between the metal and the plate, and the result would be similar to those obtained by the X-rays. Such substances as bone show clearly through the flesh and surrounding tissue. A photograph can be taken by means of radium in half a minute.

The property of the new metal is apparently of great practical value. The results of the X-rays, now so useful in surgical diagnosis, can be duplicated by a method much cheaper. Radium seems to suffer no diminution of energy or loss of weight during the process. In addition to producing an impression on the photographic plate, radium produces phosphorescence and discharges electrified bodies. Thus it will be seen that it possesses all the qualities of the Roentgen rays.

Radium apparently violates one of the fundamental laws of physics, namely, that of the conservation of energy. It does not appear to derive its photographic power from the sunlight nor lose it by expenditure.

To Destroy Vermin on Fowls.

In order to destroy the vermin with which domestic fowls are often infested, a Canadian inventor, Edwin T. Stewart, of Ottawa, has devised a nest egg which is hollow so that it can be filled with an insecticide. The nest egg is of such construction that by the movement of the fowl upon its nest the insecticide will be automatically distributed.

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Patent Department

A NOVEL BICYCLE.

The peculiarity of the bicycle shown in the accompanying illustration is that it is propelled by a person in a walking attitude instead of sitting. It will be observed that the usual sprocket wheel and driving pedals are absent, and in place of them are two spur wheels mounted on each end of a horizontal ball-bearing supported shaft, one on each side of the bicycle frame.

Means are provided for elevating this shaft to elevate the incline of the driving belts, and the latter are tightened by adjusting the telescopic brace connected with the rear fork backward or forward and securing it with a small nut on the under side. Over these wheels pass two open-meshed broad sprocket chain endless driving belts which connect with smaller pinion sprocket or gear wheels keyed on two smaller ball-bearing supported shafts located at the lower extremity of each of the rear forks of the bicycle. Mounted on one of these shafts alongside one of the pinions is a larger open gear wheel which meshes into the small driving pinion gear wheel on one end of the rear bicycle wheel ball-bearing shaft, the latter being supported upon the rear bicycle framework. At the upper end of the rear fork is a saddle which is turned into a vertical position when the bicycle is in operation, but can be used in a horizontal sitting position when coasting.

There are the usual braking appliances operated from the front handle.

To operate the bicycle the rider, steadying it by the handles, gives it a slight push forward, then jumps upon the two belts, pushing the feet alternately backward down the inclined belt as in the act of walking, raising one foot forward over one belt as the other foot is going backward on the other. The slow movement of the belt is converted into a rapid motion at the driving pinion through the medium of the large gear wheel on the shaft of the rear belt pinion.

For this bicycle, recently patented by Mr. Henry C. Weeks, of Bayside, N. Y., the inventor claims advantages over the ordinary type in the fact that the rider stands erect and brings into action many more muscles than in a sitting position, which is much more healthful and invigorating, while the weight of the body in traversing down the inclined belt assists in the power of propulsion.

The inventor states that this particular form may be modified by reducing the size of the rear wheel

WEEKS' WALKING BICYCLE.

and enlarging the size of the forward wheel, converting that into a power wheel, but maintaining the same belt form of power transmission.

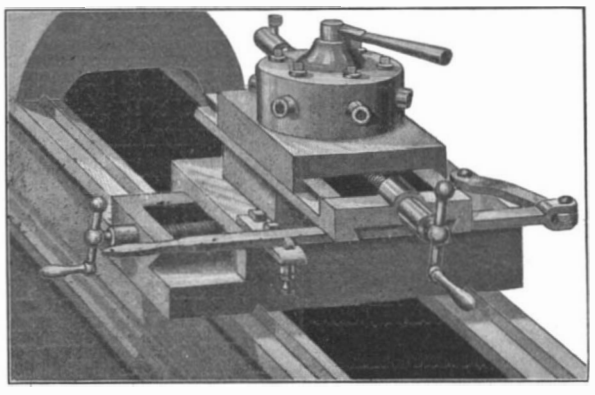
A Recreation Submarine Boat.

A Perth Amboy inventor has patented a device "whereby those who desire it may experience the novel sensation of diving in a water-tight submarine boat, making a trip under water, and coming to the surface again at the landing place." Means by which the "novel sensation" is obtained are a waterway deep enough to submerge the boat; a track in the waterway; a boat moving along the track; and mechanism for propelling the boat. The track is endless. The boat describes a circuit, so that the passengers are received and discharged at the same elevated point. This elevated point of the track is connected with the main submerged portion by inclines.

Recently we described an open submarine boat, beside which this one seems tame in the "recreation" that it affords.

LATHE ATTACHMENT.

Considerable difficulty has been experienced among machinists and brass finishers with the clutch for holding the tailstock of a turret lathe in working position. As some of our readers are aware, the turret in most turret lathes can be quickly moved forward by the operation of a hand lever, and held in this forward position by tightening a clutch on the tailstock. This clutch, while serving its purpose very well for light work, has nevertheless been found wanting in heavier classes of work. Where large reamers or cutters are used in working hard metals, the tailstock cannot be held firmly and is bound to slip. Another serious objection is that the clutch is very liable to break, entailing considerable expense for repairs. A



AN ATTACHMENT FOR TURRET LATHES.

very simple way of avoiding these difficulties has just been brought before the public by W. H. Dent, of 1030 East 169th Street, New York city. A small attachment is bolted to the lateral slide of the tailstock, as shown in our illustration.

This attachment consists of a body plate, from which projects a stop-pin for the lever and a spring latch. The spring latch is of the ordinary coil-spring and plunger type. A finger-piece on the lower end of the plunger may be grasped by the operator to withdraw the latch whenever desired. A pin carried by this finger-piece enters a hole in the sleeve of the latch, and holds the beveled end of the latter normally in proper position. It also serves to hold the latch out of the path of the lever when desired. This is done by slightly turning the finger-piece after the latch has been withdrawn. The advantages of this device are evident. The turret can be brought in play by a single stroke of the hand-lever; no time is wasted in tightening a clutch. No slipping can occur with this clutch, no matter how heavy the work, and there is less danger of breakage. Should the attachment break, the only repairs necessary would probably be the replacing of a broken latch, or at most a new supporting plate. The expense entailed would be so trifling as to hardly need considering. With the present arrangement, on the contrary, the entire lateral slide on which the clutch is formed has to be replaced in case of a break. Manufacturers of this lathe will find it considerably cheaper to build, and they can reduce the weight of the machine by at least ten pounds. On a machine equipped with this new device it is claimed that a mechanic can in eight hours turn out work requiring ten hours on the present lathes.

The Romantic Side of Inventions.

Three remarkable instances are known in which the Yankee boy's trick of whittling led to valuable inventions. According to a writer in the Stationary Engineer and Machinist, the elder Cunard, who was apprenticed as a lad to a Scotch shipbuilder, is said to have amused himself in whittling the hulls of vessels. Occasionally he would fit one of these with masts, sails and rigging complete. Tired of familiar types, he would experiment with new ships, and one of these it was that attracted the attention of his master, because it would not maintain its upright position in the water. Experiments were made to ballast it, in order to give it the proper trim. The clipper-like shape and graceful, long lines of the model promised great speed. Such is said to be the origin of the standard model of the Cunard and later ocean greyhounds.

Robert Livingston Stevens had grown to man's estate when he sailed from New York to Liverpool, eighty years ago. But he had not outgrown his love of whittling. In those days the passage took two months, and Stephens passed many an hour, jack-knife in one hand and a piece of wood in the other, brooding over a problem that had often worried him—how to run a railroad without stone stringers for tracks. He wanted to get an iron rail that would "hold," and would take the place of the thin strips fastened to the chair of the roadbed. Just before he reached England, his whittling revealed to him the solution of his problem, and that solution took the form of a T-rail with a broad base that could be applied direct to a solid wooden support. That T-rail is still in use on all railways of the world.

To an English machinist, Joseph Jenks, belongs the honor of having secured the first American patent. A blacksmith in Hammersmith, England, in 1643, he was a man of great renown, by reason of his inventive skill in the art of making machines. Emigrating to the Colony of Massachusetts in the fall of 1643, about the same time that Rev. John Harvard arrived, he settled in Lynn. This man Jenks cut the dies for the coining of the old colonial "pine tree" money. He also invented the first apparatus for extinguishing fires, a kind of primitive hand-pump on wheels. His application for a patent on a water-power device for mills was granted by the colonial court, and is probably the first patent on record in America. The court had jurisdiction over the Massachusetts Bay Colony, embracing nearly all of New England at that time. The limit of the monopoly was fourteen years, and the court retained not only power to forbid exportation, but also power to prevent exorbitant charges made upon the public. The patent was issued in this form:

"At a general Courte at Boston the 6th of the 3rd Mo. 1648. The cor't consid-inge ye necessity of raising such manifactures of engins of mils to go by water for speedy dispatch of much worke with few hands, and being sufficiently informed of ye ability of ye petition to performe such workes grant his petition (yet no other person shall set up or use any such new invention, or trade for fourteen years without ye licence of him the said Joseph Jenkes) so farr as concerns any such new invention, & so it shall be always in ye power of this co'te to restrain ye exportation of such manufactures & ye prizes of them to moderation if occasion to require."

ILLUMINATED INDIAN CLUB.

We have all doubtless noticed the effect produced by rapidly swinging a lantern in the dark. The impressions produced by the light linger on the retina of the eye, so that, instead of a single-point light, one imagines he sees a whirling stream of fire. Mr. John Creelman, of Suffern, N. Y., has invented an illuminated Indian club with which this illusion can be very pleasingly effected. The club has a hollow perforated body threaded at the lower end to receive the handle portion. Secured to the handle and adapted to enter the hollow body, is an incandescent lamp. Electricity is conducted to the lamp by means of wires passing through the handle, and connected to any suitable source of electric current. When the current is turned on, the light radiates from the numerous perforations in the club. One acquainted with Indian club exer-

ILLUMINATED INDIAN CLUB.

cises can give his audience a very fascinating entertainment, especially if colored lamps be used instead of the ordinary white light.

Appafatus for Preventing Collisions at Sea.

A Russian inventor, Nicolas Gherassimoff, of St. Petersburg, has devised an apparatus which is intended to prevent collisions at sea. The apparatus is operated by the use of contact devices which he calls "feelers." The feelers move in advance of the ship and at such a depth as not to be materially interfered with by the waves. They are so disposed and connected as to indicate an obstruction, stationary or floating, beneath the surface, whether in the direct course of the ship or on one or the other side. The diversion of the feelers from a straight course, due to their collision with an obstruction in their path, or to the action of such obstruction on their connecting devices, is made use of to indicate the course that the vessel is to take in order to avoid the obstruction.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

BEET-PULLER.—M. W. PALMER Hamilton, Mich. The distinguishing feature of this implement is the construction which permits lifting the beets free of the ground without materially disturbing or breaking up the soil. The device somewhat resembles a mole plow, inasmuch as the beet-lifting means runs under the ground and is adapted to be drawn by horse power.

BEET-HARVESTER.—M. W. PALMER, Hamilton, Mich. The invention relates particularly to means for cutting off the tops of beets. Provision is made to limit the inward movement of the cutters toward each other and yet permit the cutters to move apart for the passage of unyielding obstructions. The cutters are of such construction that any one or more of the blades can be replaced whenever desired without interfering with the others.

CORN HARVESTER AND HUSKER.—T. P. and H. WEICHEL, Plymouth, Neb. These inventors have provided an improved corn harvester and husker which is simple and durable in construction, very effective in operation, and arranged to positively pull the ears from the stalks, to tear off the husks, and to finally discharge the husked ears in a wagon or other vehicle traveling alongside of the machine.

Electrical Apparatus.

COMBINED HOSE AND ELECTRIC SIGNALING DEVICE.—H. T. CRONK, New York, N. Y. The coupling is particularly adapted for connecting the hose sections of fire engines, being designed to preserve a tight joint even at high internal pressure and to allow the connection being made and unmade quickly. Complete separation and insulation of the metal parts is assured, thus permitting its use in connection with electric circuits along the hose.

APPARATUS FOR INSULATING OR COVERING STRANDS AND FORMING SAME INTO CABLES.—H. W. DOVER, Northampton, England. This invention relates to the manufacture of electric cables, and consists of apparatus for covering with celluloid, xylonite or similar material the conductors (whether plain or stranded wires) and also wire or fibrous cords surrounding the conductor, and forming the whole into a cable at one operation.

METHOD OF COVERING ELECTRIC CONDUCTORS AND MAKING CABLES.—H. W. DOVER, Northampton, England. The invention relates to the manufacture of telephonic and telegraphic cables at a single operation by the application of the insulating and protective material simultaneously to the conductor and to wire or fibrous cords used to impart tensile strength to the cable. The wires are protected from destructive influences by the insulating material in which they are embedded. The insulating material is applied by extrusion in the plastic state through a die which is traversed by the wires and cords to be covered, a twist being at the same time imparted which is rendered permanent by the setting of the insulating material.

Miscellaneous Inventions.

DUPLICATOR.—S. CASE, Montezuma, Ind. The device is designed for duplicating or manifolding checks, bills, and the like. The paper strips may be easily inserted in the duplicator which is simple and compact in construction and arranged to be conveniently carried in a person's pocket.

HOLDER FOR DUST-PANS, BROOMS AND DUST-BRUSHES.—J. M. MILLER, Crestline, Kan. This simple device is attachable upon the wall of a room at a suitable height from the floor, and affords convenient and reliable means for support of a dust-pan, broom, and dust-brush when the same are not in use.

VENTILATOR FOR FIRE-SURFACES OF RANGES.—A. E. MINNS, Brooklyn, N. Y. The construction of the device is such that in broiling, frying, or otherwise cooking food the smoke and odors will be compelled to pass down over the bed of the fire and find an exit through the flue, thus effectually preventing odors and smoke from escaping into the room.

CURRYCOMB.—C. E. HERSHBERGER, Luray, Va. The currycomb is designed to enable its face to better conform to the curved outlines of the horse. It is designed also to permit of the ready cleaning of the teeth of a currycomb from the accumulated mass of loose hair and dirt.

Designs.

CHAIR BACK.—A. WANNER, JR., Hoboken, N. J. Mr. Wanner has received two patents for designs in chair backs. The leading feature of the first design is the internal members crossing each other and having their lower ends touching the side portions of a marginal frame and their upper portions curved outwardly upon themselves.

The leading feature of the second design is the internal members within a marginal frame and extending in upwardly diverging relation from a stem and having inwardly curved portions which overlap one another.

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Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

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Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 2594.—For manufacturers of small glass tubes of special dimensions.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 2595.—For manufacturers of ice machines.

WATER WHEELS. Alcott & Co., Mt. Holly, N. J.

Inquiry No. 2596.—For manufacturers of spring steel wire.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 2597.—For makers of steel springs.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 2598.—For dealers in paper boards for experimental purposes.

If making metal goods and needing special parts, write us. Metal Stamping Co., Niagara Falls, N. Y.

Inquiry No. 2599.—For makers of soda water pumps.

Machinery designed and constructed. Gear cutting. The Garvin Machine Co., 149 Varick, cor. Spring Sts., N. Y.

Inquiry No. 2600.—For parties to manufacture a very light but powerful motor for use on an air machine.

We design and build special and automatic machinery for all purposes. The Amstutz-Osborn Company, Cleveland, Ohio.

Inquiry No. 2601.—For large dealers in bamboo.

WANTED.—Position as foreman in machine shop by competent man. Address C. M. S., No. 286 Humphrey St., New Haven, Conn.

Inquiry No. 2602.—For manufacturers of merry-go-rounds.

Manufacturers of patent articles, dies, stamping tools, light machinery. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 2603.—For granulated carbon for telephone transmitters.

PATENT FOR SALE.—Additional fixture to windmill to insure steady motion in change of wind. C. Oberlaender, care Missouri Presse, Springfield, Mo.

Inquiry No. 2604.—For manufacturers of German enamel ware.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 2605.—For machinery for manufacturing salt and for evaporating purposes.

IDEAS DEVELOPED.—Designing, draughting machine work for inventors and others. Charles E. Hadley, 584 Hudson Street, New York.

Inquiry No. 2606.—For parties to manufacture cane handles of hardwood and of special dimensions.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Inquiry No. 2607.—For dealers in liquid air.

Patents developed and manufactured, dies, special tools, metal stamping and screw machine work. Metal Novelty Works Co., 43-47 S. Canal St., Chicago.

Inquiry No. 2608.—For makers of punches and dies, etc.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

Inquiry No. 2609.—For dealers in tin implements exclusively.

WANTED.—A good engineer capable of taking care of five blast furnace blowing engines, stating age, experience, references, etc. Address the Columbus Iron and Steel Company, Columbus, Ohio.

Inquiry No. 2610.—For makers of hat cleaning machines.

Manufacturers of slot machines, vending of every description, bar supplies and novelties. Send illustration with lowest cash price, f. o. b. New York. Large quantities. J. Landes, 108 Pitt Str., Sydney, Australia.

Inquiry No. 2611.—For machines for making bricks out of sand by pressure.

Information about Corporations.—Business Corporations, their incorporation, organization and procedure. Send for our new list of practical corporation books, blanks and materials. The Ronald Press, 170 B'way.

Inquiry No. 2612.—For manufacturers of paper bag making machinery.

Patent store door show-case and frost preventor, using the glass in the door for a lid, for sale, United States, $350; Canada, $250. Patent self-rising doll, cost 50 cents a dozen to manufacture, United States, $250. W. G. Flint, San José, Cal., U. S. A.

Inquiry No. 2613.—For machinery for making excelsior.

Press work done at short notice. Blanking and drawing our specialty. Estimates cheerfully furnished. Tools for all work made on premises if desired. Copper, brass and nickel plating. Correspondence solicited. Acme Ball-Bearing Caster Co., Chappaqua, N. Y.

Inquiry No. 2614.—For dealers in gasoline gas motors and engines of ⅛ or ¼ horse power.

Inquiry No. 2615.—For makers of mechanical stokers.

Inquiry No. 2616.—For the manufacturer of braided metal center fish lines and of braided silk lines.

Inquiry No. 2617.—For dealers in pure silica and Fuller's earth.

Inquiry No. 2618.—For makers of gas plants or apparatus for producing either coal or acetylene gas for factory use.

Inquiry No. 2619.—For dealers in railroad velocipedes and light inspection cars.

Inquiry No. 2620.—For dealers in gutta percha tissue cement for tailors' use.

Inquiry No. 2621.—For electrical schools, west of the Mississippi preferred.

Inquiry No. 2622.—For makers of round mailing cases for sending liquid, etc.

Inquiry No. 2623.—For manufacturers of small carpet-cleaning machines.

Inquiry No. 2624.—For machines for stringing and tying strings on tags.

Inquiry No. 2625.—For makers of wire gauze lamp wicks.

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May 13, 1902,

AND BACH BEARING THAT DATE.

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Advertising device, C. F. Schell..... 699,718
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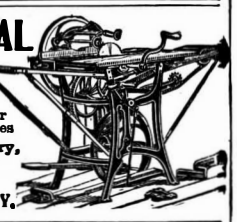

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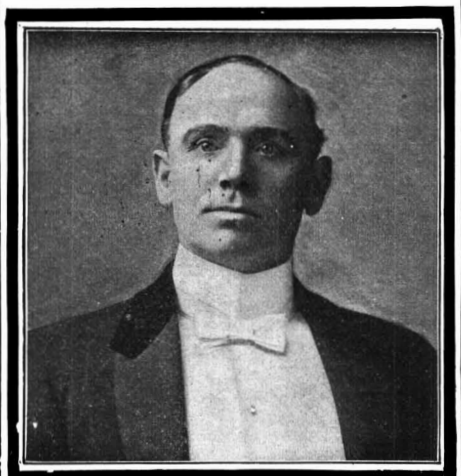

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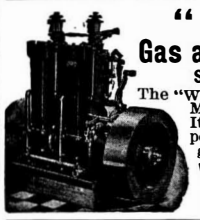

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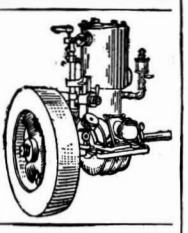

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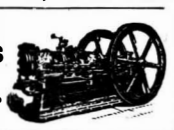

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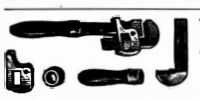

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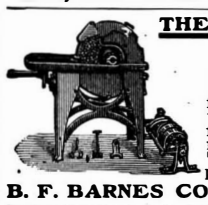

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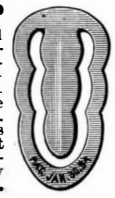

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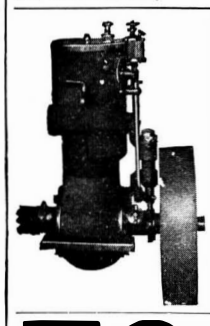

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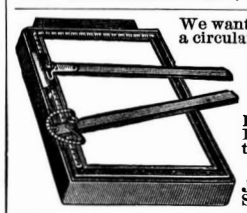

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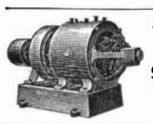

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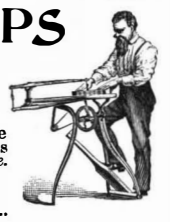

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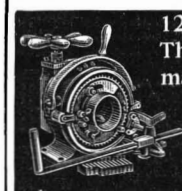

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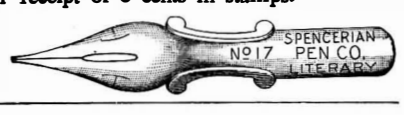

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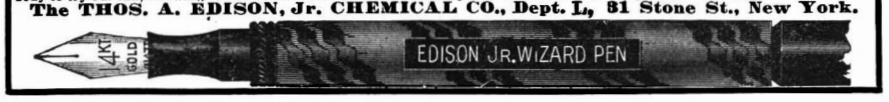

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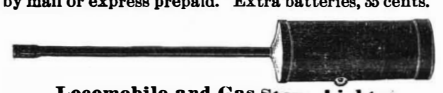

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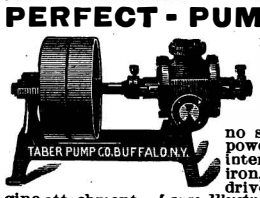

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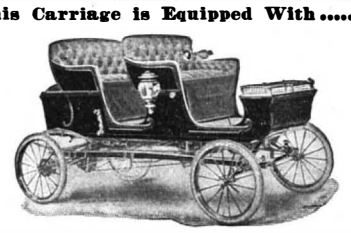
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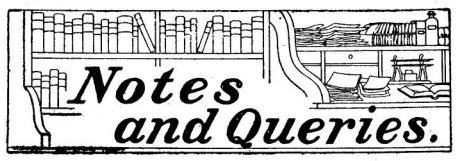

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Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
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Scientific American Supplements referred to may be had at the office. Price 10 cents each.
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(8608) A. J. P. writes: I have seen a thermometer with a storm indicator on the same perpendicular support. This indicator is sealed, so one can turn it upside down without spilling the contents. In the bottom of same there is a salt, and the rest of the tube is nearly filled to the top with a liquid. According to the condition of the weather, this salt rises in the tube, rising nearly to the top, in stormy weather. Now if the tube is sealed, how can the pressure of the atmosphere have any effect on the contents? Or how can the moisture of the atmosphere communicate itself to the salt? What kind of salt is in the tube? Is this a reliable instrument? A. The instrument you describe is usually filled with alcohol in which camphor is dissolved. The tube is then sealed by melting the end of it in a blast lamp. After this is done neither the moisture nor the pressure of the air has any effect upon the contents of the glass. The heat of the air would seem to be the only form of energy which can change the condition of the contents of the tube. You can determine for yourself by observation whether the instrument is reliable. We should prefer a mercurial barometer as a weather indicator. Instruments which are affected by moisture or heat are slower than those which respond to the change in the pressure of the air, and the weather often changes before they show any indication of change.

(8609) B. B. H. asks: 1. Which is the best to use in wireless telegraphy? A cylinder made of a sheet of copper, say No. 12 to 14, or the sheet of copper straight? A. Both cylinders and sheets are used for sending messages over short distances by wireless telegraphy. 2. Is a sheet of copper No. 12 to 14 plenty big enough to use with half-inch spark coil, where the stations are about 500 feet apart? A. Probably the size of sheet you name will transmit to the distance you wish. 3. Would it work all right where there are two stations about 300 feet apart, for one to use a ¼-inch and the other a ½-inch spark coil? A. The coils at the two ends are not necessarily the same in size. They do not work together at all. If the smaller coil can transmit its own messages, it will answer the purpose. 4. How many ampere hours are there in a gravity battery? How many gravity batteries will it require to charge a 50-ampere-hour storage cell? Norrie in his book ("Induction Coils") says he charged a 50-ampere-hour storage cell with five gravity batteries. Is that possible? A. A gravity cell has a mean working E. M. F. of about one volt, and an average internal resistance of about one-half an ohm. It should deliver on a small external resistance about two amperes. The number of ampere hours it can give depends upon the size of the zincs, and cannot be told as an absolute amount. Five gravity cells will yield 2½ volts, which is the proper pressure for charging one storage cell. 5. Has liquid air ever been analyzed? If so, what were the elements composing it? A. Liquid air does not require analysis. It is ordinary air turned into a liquid, and has the same composition as any other air—79 parts of nitrogen and 21 parts of oxygen when first liquefied.

(8610) H. G. asks: Am interested in wireless telegraphy, and reading about it in the September 14 number, want to construct one. I would like some information regarding the construction of a coil that would give ½ or 1 inch spark. A. The construction of a good coil is to be found in SUPPLEMENT No. 160, price 10 cents. This gives a spark somewhat longer than an inch, but an excess is better than a deficiency of power in doing any work.

(8611) F. X. D. asks: Whether chloride of gold after having been liquefied can be used in the toning bath. Some time ago a bottle was opened and not sealed properly, and now the gold is a liquid. Can it be used in any way? Or must I buy a fresh bottle? A. Chloride of gold is a very deliquescent substance; that is, it absorbs water from the air and dissolves in it with ease. No harm is done by this. You only need to add water enough to the liquid now in the bottle to make the required quantity, and you can then mix the toning bath as if the chloride of gold were solid when you began.

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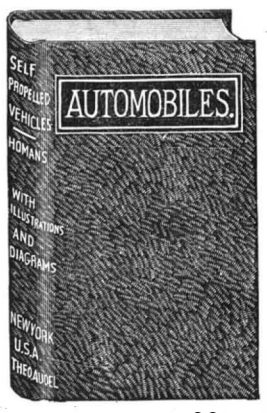

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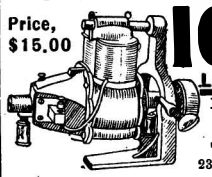
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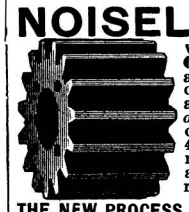
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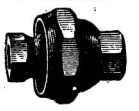
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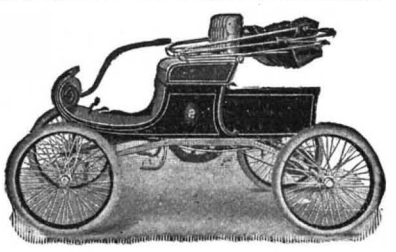

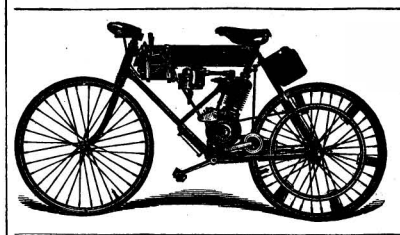
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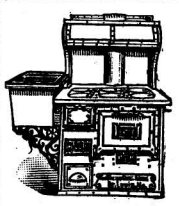
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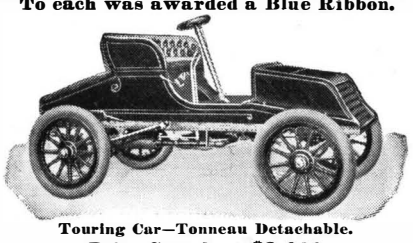

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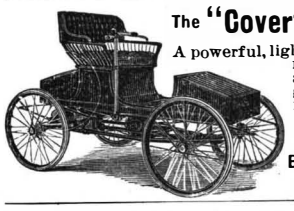

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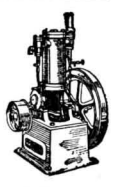

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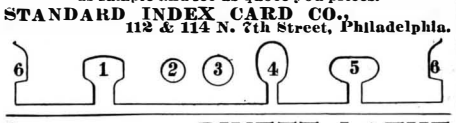

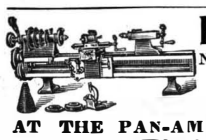

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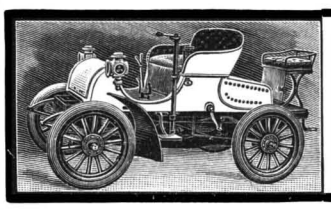

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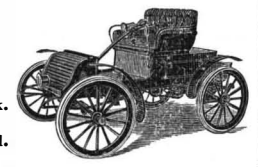

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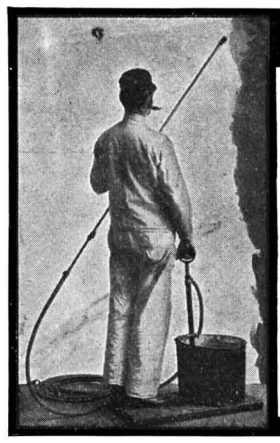

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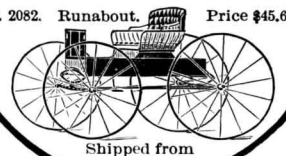

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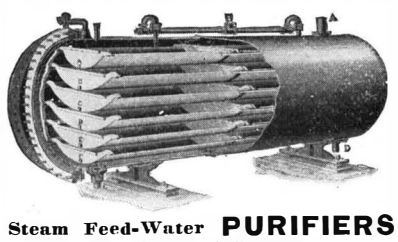

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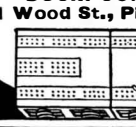

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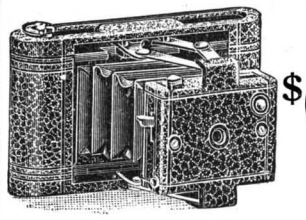

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